ELECTRICAL REVIEW

February 7, 1947

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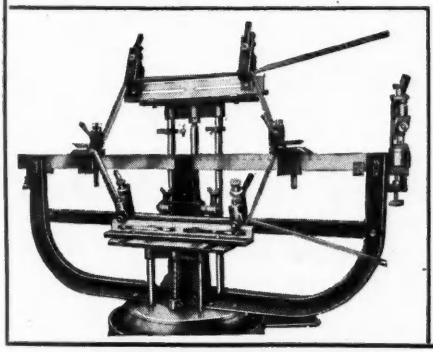

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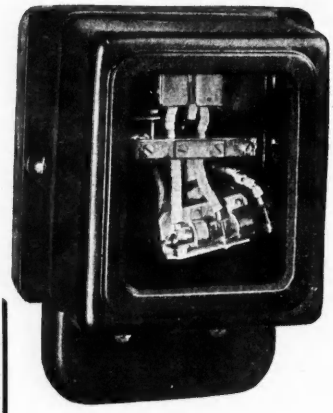

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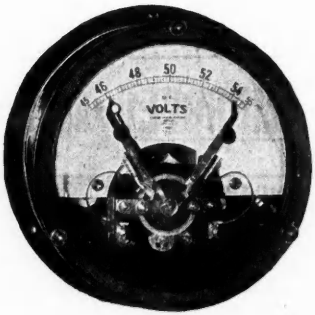

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ELECTRICAL REVIEW

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The Electricity Bill

Considerations for the Committee Stage

THE passing of the second reading of the Electricity Bill, in spite of some very sound arguments against it from Opposition speakers, was a foregone conclusion. In his presentation of the case for the Government Mr. Shinwell, Minister of Fuel and Power, was fortified by the undisputed fact that " reorganization " (though not necessarily nationalization) of electricity supply has been in the programme of every political party. Moreover, by putting forward their individual and joint proposals the different sections of the industry itself had tacitly admitted that " something ought to be done."

Constructive Improvements

Maybe earlier reform from within would have averted nationalization, but this is by no means certain. It might merely have made the taking-over by the State an easier process. Now we must accept the Bill as something that cannot be avoided. This is not to adopt a " defeatist " view. Efforts designed to secure its rejection have failed in the face of the Government's big battalions : they must now be diverted to more constructive ends. The Bill is being remitted to a Standing Committee and it is during this stage that argument and persuasion must be brought to bear in an attempt to remove or improve unworkable, undesirable or unnecessary features.

It may be well to refer to some of these features. We will say little of the terms for the acquisition of undertakings, discussion of which has overshadowed other important points. Independent valuation of individual undertakings would undoubtedly be fairer than Stock Exchange quotations as a basis for compensation, but it would have been a complicated and lengthy business. The Minister preferred a short cut and his claim for the fairness of the basis which has been adopted is at least plausible, if not entirely acceptable to shareholders.

Contact with Consumers

The size of the fourteen areas is widely considered to be too great. There is a fear that the intimate contact with consumers which has accounted for a great deal of the industry's success will be lost —even with the intervention of the Consultative Councils of which there is to be only one for each area. It is true that " committees or individuals " may be appointed to be local representatives of the Council to consider the particular circumstances and requirements of localities. But these representatives will still be, in effect, the " creatures " of the Area Boards and too much subject to direction.

We would like to see more independence in this matter: nuclei already exist in a very large proportion of the localities in the form of Electricity Committees. These may be by no means perfect but at least they have had a great deal of experience of the " particular circumstances and requirements " of their districts.

Another matter which is regarded as " dangerous " to the future is the amount of " patronage " which the Bill places in the Minister's hands. He is to appoint

the members of the Central Electricity Authority and the Area Boards (all paid jobs) as well as the unpaid Consultative Councils. Somebody has to appoint the principal authority but once appointed it seems to us that it should have greater freedom of action—particularly freedom from any sort of political interference.

We have already stated the case against the clause which gives the Central Authority manufacturing powers and the Area Boards sweeping sales and installation powers (*Electrical Review*, January 24th). We again urge the Minister and his colleagues in other related Departments to consider the dangers to the British electrical manufacturing industry if such powers are not circumscribed.

As the Bill will soon become law, everything possible must be done to ensure that it will achieve the aim " to develop and maintain an efficient, co-ordinated and economical system of electricity supply " without causing permanent injury to the industries and individuals involved in the reorganization.

Rates and Charges

MUNICIPAL opposition to the Electricity Bill is based mainly on the loss of rate relief which they will suffer when their undertakings are acquired; no provision is made for this in the terms of acquisition. Our view has always been that electricity consumers should not, in effect, have had to pay extra rates but were entitled to lower charges if an undertaking made large profits. In this we have the support of Mr. D. Bellamy, general manager of the Hull undertaking. He goes so far as to say that consumers who have contributed to rate relief may actually get their electricity cheaper when the burden is removed. At Hull the electricity undertaking has not been called upon to make any contributions for the relief of the rates. Mr. Bellamy says that " Hull's compensation for its policy has been cheap electricity for its community. Any suggestion of further compensation on this item is a duplication."

Temperature Control

OVERHEATING as well as underheating of dwellings and workshops is bad for health and comfort and therefore for efficiency. The amount of coal that can be wasted in this way is not always appreciated, but a recent pamphlet of the Ministry of Fuel and Power gives an easily memorized rough basis. It is that fuel consumption increases by 5 per cent for each degree above the 60 deg F needed for sedentary work. Careful control (thermostatic if possible) of temperature would undoubtedly make very considerable savings when applied to the 25 million tons estimated to be burned for warming factories and offices and to the large proportion of the 45 million tons used on domestic and non-industrial premises.

Technical Colleges

THE importance of technical colleges to the future of the country's industry is illustrated by the position assigned to them in the Reports on Education and Training of Engineers drawn up by the Institution of Electrical Engineers. It follows that these colleges, especially the smaller and less well known of them, need help in securing teachers of the requisite experience, adequate buildings and up-to-date equipment. The technical college is essentially local in its activities and the plea of Mr. J. F. Yates in this issue deserves careful consideration by industrialists, who draw recruits to their engineering staffs not only from those towns that are served by the better endowed colleges but also from areas where present facilities for technical education are meagre.

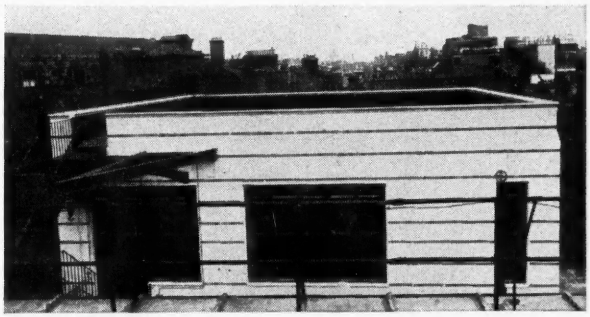
Machine Design

THE discussion of Mr. L. H. A. Carr's I.E.E. paper last week probably centred too much on the author's criticism of the teaching of the principles of electrical design in colleges. The consensus of opinion was that design should not be taught in colleges, since it would lead to too early specialization and would, moreover, overload the curriculum with a subject that would ultimately concern only a small proportion of students and would then result in too early specialization. The need to limit college teaching to fundamentals that would give the prospective designer a clear concept on which to base his subsequently acquired knowledge of technical and commercial considerations was emphasized. This was not out of harmony with Mr. Carr's views, as we understand them. The paper should perhaps be regarded as a well-thought-out basis for a specialized post-graduate course.

London Load Building

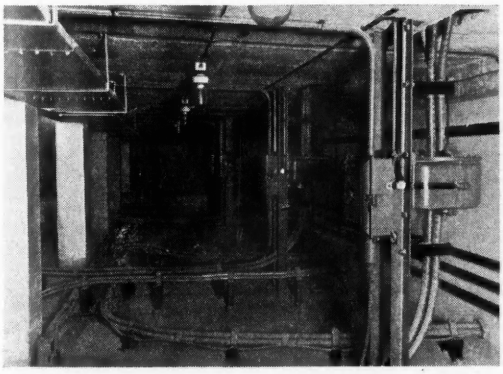
III—Distribution in a Densely Loaded Area

IN the *Electrical Review* of January 3rd and 24th accounts were given of the generation and main transmission activities of the London Power Co., Ltd., portraying the essential technical and practical "production and wholesaling" aspects of the company's arrangements for meeting the demands in an area which is probably unique, at least in regard to its load density. The next logical step is to show what has been, and is being, done to take the supply to consumers' premises, and for practical reasons, at this stage, we confine our attention to the area served by Central London Electricity, Ltd., one of the undertakings which receives a bulk supply from the London Power Co., Ltd.



Floor-space at the St. Martin's Lane bulk-supply substation is limited by the congestion of buildings all around it

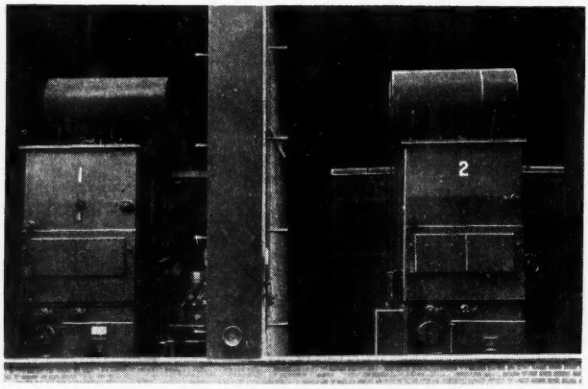
This undertaking resulted from the amalgamation of six earlier undertakings with adjacent areas of supply in which the conditions, as regards standards of living, range almost from the highest to the lowest. The electricity supply conditions also varied very considerably at the onset when there were fourteen different consumers' voltages, four different high voltages, as well as single-phase, two-phase, three-phase and six-phase a.c., and two-wire, three-wire and four-wire d.c. systems. The scheme adopted to bring all the electrical conditions into line in the development of a single system common to the amalgamated area was based on the standardization of distribution units throughout the area, and were described fully in a paper "Standardization of Distribution in Densely Loaded Areas," presented by Mr. J. W. Leach, M.I.E.E., engineer-in-chief of Central London Electricity, Ltd., to the Institution of Electrical Engineers and published in the *Journal* of the Institution, Volume 88, Part 2, No. 6, December, 1941.



St. Martin's Lane cable basement is divided up by fire-protection walls ; 22-kV section

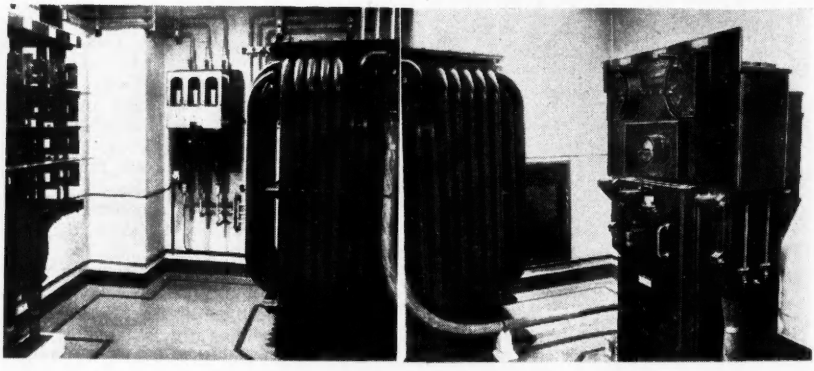
It is not our purpose to describe the system in the pure technical or engineering sense, but rather to show the part which it plays in the wider scheme which is being dealt with in this series of articles treating of the essential load-building aspects. It may be useful at this stage, however, to repeat a few points in Mr. Leach's paper which have a special bearing on the matter.

Two of the seven "essential features in applying a standard distribution system" are—(*b*) plant load factor should be the highest possible consistent with adequate standby; (*c*) the load growth should be met in small increments with a minimum disturbance to existing plant and networks." Further: "The ideal system for densely loaded areas is one wherein the area is overlaid with a symmetrical grid at the voltage of supply to the consumer, with injections made into this grid from a primary h.v. network through decentralized transforming plant, using units approximating in rating to and in the position of the larger consumers. Standardized plant is used in the main substations and distribution substations, the switchgear being rated at 250,000 kVA in the former and 150,000 kVA in the latter. There is no need to increase these ratings as load develops, since the growth is met by increasing the number of units."



Each transformer on the ground floor is in a cubicle

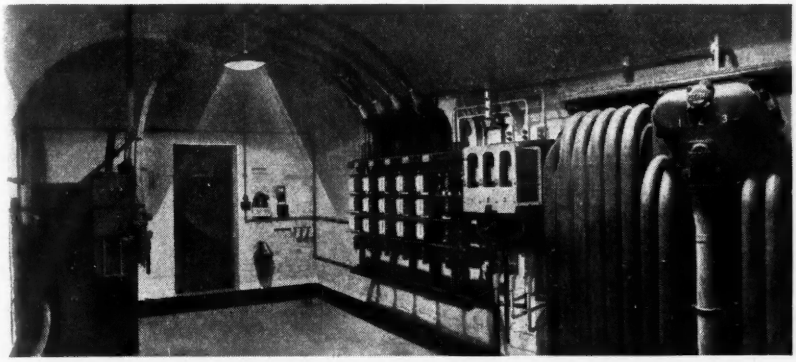
The area of Central London Electricity, Ltd., is about 6½ sq miles, excluding parks, bounded roughly on the north by Oxford Street and on the south by the Thames, and it stretches roughly from the Tower of London in the east to Earl's Court in the west. It is right in the heart of London and fully built-up, and it includes the most expensive sites and properties. Buckingham Palace, the Houses of Parliament, the principal Government Offices and the Bank of England are among the many buildings of outstanding national and international importance and interest in the area. There is a fair amount of light industry (mainly printing) in the east, but the predominating loads are those of the commercial premises in the east, the residential districts in the west, and the shopping and entertainment centres in the middle. The load density varies from about 100,000 kW per sq mile in the east to about 12,000 kW per sq mile in the west, and the



Opportunity to plan for the distribution transformer chamber at St. Martin's Lane has made it almost ideal in lay-out

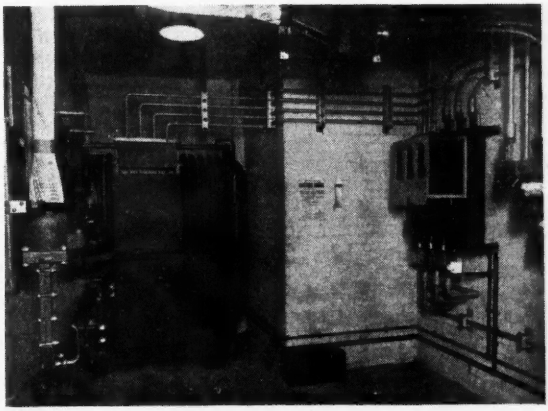
peak-load times vary with the ways of people, earlier in the east and later in the west.

A bulk supply is received at 22 kV at each of the following thirteen points which had been established by the original companies within the area: Old Brompton Road, near West Brompton Station, on the site of the original generating station of the Brompton and Kensington Co.; Pelham Street and Cheval Place, both in the area of the old Kensington and Knightsbridge Co.; Alpha Place on the site of the generating station of the old Chelsea Co.; Eccleston Place and Horseferry Road on the sites of the generating stations of the old Westminster E.S. Corporation; Duke Street, underneath a specially constructed ornamental garden just south of Selfridges; Carnaby Street, on the site of the generating station of the old St. James and Pall Mall Co.; St. Martin's Lane, north of Trafalgar Square; Shorts' Gardens, at the top of Drury Lane; Ludgate by Ludgate Circus, and at both Cannon Street and Fenchurch Street near the railway stations of the same names.



The low-voltage distribution gear has top-entry cables in the transformer chamber in an arched cellar in Somerset House

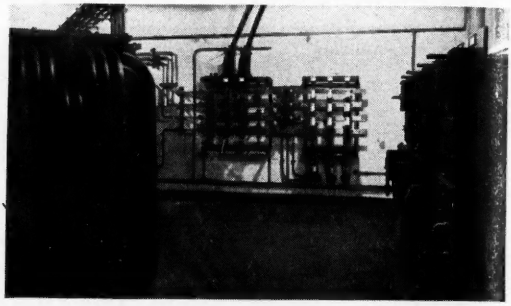
These bulk-supply points are laid out and developed for equipping with up to a maximum of 50,000 kVA of plant for supplying a defined area around it which demands, say, from 36,000 kVA to 40,000 kVA, maximum. The bulk-supply substation at St. Martin's Lane is a new one, replacing one which was totally destroyed by enemy action during the war. It is therefore a good one to choose for some detailed references, but in principle it is typical of the whole of the bulk-supply substations. It is in a very congested area and its physical floor-space limitations are those created by the buildings all round it. There are four main floors. Transmission (22-kV) and main distribution (11-kV) switchgear are housed in the basement, while at the ground level there are, or will be, four



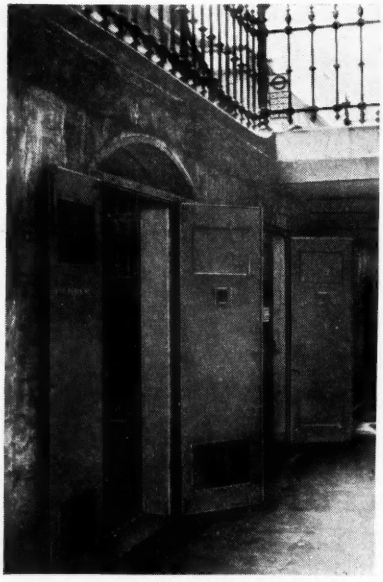
H.v. ring-main unit in the Adam Street distribution transformer chamber with two circuit breakers—one for an incoming trunk feeder

12,000-kVA, 22/11-kV transformers with on-load tap changing. On the first floor are the offices and auxiliary equipment, including CO_2 fire protection apparatus and high-frequency injection control apparatus, and the top floor mainly constitutes the control room. There is provision for an extension for housing two 25-MVA, 66/22-kV transformers and isolating switchgear later on, and the building is also designed for additional floors up to the maximum permissible height when required.

A cable sub-basement divided by suitable fire walls is provided over the whole site, so that cables may enter the building from all directions. The plant is segregated into four sections by means of division walls to limit the risk of spread of fire. A substantial spine wall divides the substation into two halves, and further walls divide the transformers and switchgear into separate fire zones or sections. Oil dams and raised concrete bulkheads around all cable holes in the floors are provided to ensure that oil cannot escape or find its way out of any of the switchrooms or transformer cubicles. External sumps for oil are not provided (they constitute a risk in themselves, and on these congested city sites there is nowhere suitable to put them). The oil has to be retained in the affected zone and dealt with there by means of CO_2 equipment. A comprehensive automatic CO_2 fire protection installation covers all sections of the switchgear and transformers and has a sufficient number of cylinders to provide in each section for an automatic discharge (initiated by fuseable links) followed, if desired, by a second or reserve discharge under manual control. Roller shutters arranged to close automatically with the CO_2 discharges are fitted to the fronts of the transformer cubicles, but the equipment is designed to provide sufficient gas concentration without the operation of these shutters.



In an Admiralty 1,000-kVA distribution transformer chamber the ring-main unit has three circuit breakers—two transformers and a trunk feeder



" Coal-cellar " development : distribution transformer chamber at 56, Victoria Street

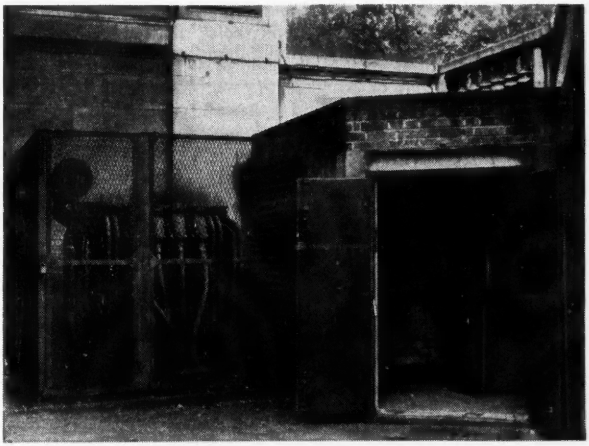
The bulk-supply substations are interconnected through the London Power Company's transmission system, but the method of distribution from these bulk-supply substations is organized on the unit system whereby each bulk-supply substation supplies a definite geographical area. The areas largely coincide with the areas of the former separate undertakings.

Subsequent to the amalgamation, the distribution scheme has been developed around the original bulk-supply points on standard lines whereby each bulk-supply point with its associated district is a " unit " for distribution purposes. In each unit the original distribution system or part of a system has been developed, with modifications, alterations, extensions and replacements, thus

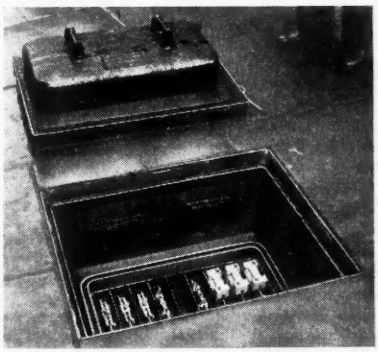
co-ordinating it into a consistent plan. Each district or unit has been further divided into four sections, each of which is supplied by a group of four high-voltage (11-kV) feeders, arranged as a ring main but operated radially, served by one of the four sections of 11-kV switchgear in the bulk-supply substation.

Each 11-kV radial feeder supplies about six transformer chambers or distribution substations of a standard design, in principle, although the layouts vary considerably with the shapes and physical sizes of the chambers which are often secured by way of Hobson's choice in any suitable space which happens to be available in building basements, court areas, and so on. The apparatus, which is all standardized, may be taken from stock and fitted in.

The average transformer chamber is equipped with an 11-kV ring-main switchgear unit, an 11-kV/400-V, 500-kVA transformer, an 800-A, 400-V air circuit breaker, and a



One of the few separate outdoor buildings: Grosvenor Gardens



L.v. network interlinking is generally effected in street boxes at points where least transfer of load takes place

400-V link or fuse distribution board or multiples thereof. The h.v. ring-main unit usually consists of two manually-operated isolator switches in the ring main, and an automatic circuit breaker serving the transformer. The switchgear has a rupturing capacity of 150 MVA, and the ring-main isolator switches have been proved for making this fault current and for breaking the full load of the feeder.

The cable-box arrangements are specially designed to permit cable approach from above or below without the need for cable trenches of any kind. There are two link switches on each circuit breaker operated by a front handle for " on," " off " and " earth." They are used for splitting the ring main on either side of the circuit breaker as well as for ring-main interconnections, in which case the outgoing cable is taken to the other ring main instead of to the transformer. Each unit is 3 ft 6 in. wide, and the depth with the full draw-out is 6 ft. A plant load factor of 75 per cent is aimed at throughout all the distribution transformer chambers.

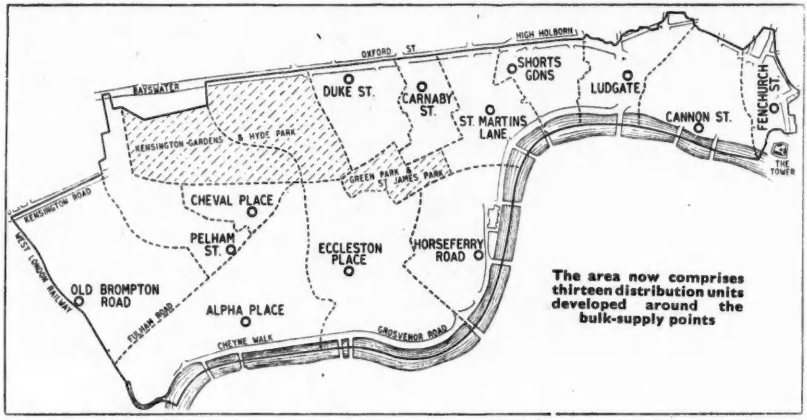
Although the unit system so far described is followed throughout the whole of the area concerned, in some cases it has not yet been completely developed. For instance, in the district served by the St. Martin's Lane bulk-supply substation only three district sections have so far been established with supplies from the new bulk-supply substation, so that at present there are only three 22/11-kV transformers at St. Martin's Lane. There is also a fair amount of d.c. still supplied in different parts of the area, usually by means of rotary equipment in the

bulk-supply substations. The d.c. supplies are not, however, regarded as in any way progressive in the development of the system, and the installing of new d.c. plant is avoided; they are being converted as opportunities occur, so that from the special angle from which this article is written there is no reason to refer to the d.c. other than to acknowledge its present existence.

As with the bulk-supply substations, there is no point in referring directly to more than one of the unit districts, so we will take the St. Martin's Lane district or unit which has the approximate boundaries of Wardour Street in the west, Bow Street in the east, Oxford Street in the north and Horseguards' Avenue in the south. When fully developed this unit will have the four sections referred to, each served by the high-voltage radial feeders in the form of a ring main to which the distribution transformer chambers are connected. There are fifty of these transformer chambers in this distribution unit, and the following references to a few of them which we visited, and the accompanying illustrations, will serve as typical examples.

As a matter of interest, the adjoining two units, namely St. James' and Mayfair, where the average load densities are of the order of 100,000 kVA per sq mile, have just about reached their full development, and plans are under consideration for the carving out of another bulk-supply unit in the combined districts and the installation of another bulk-supply station to meet oncoming development of load.

One of these transformer chambers is situated at the sub-basement level in the St. Martin's Lane bulk-supply substation. It is a standard 500-kVA chamber, measuring about 15 ft by 17 ft, and because of the opportunity to plan for this in advance it probably approaches the ideal in lay-out, compatible with compactness, with its low-voltage link and fuse gear and high-voltage ring-main equipment on opposite walls and the transformer centrally disposed. The low-voltage circuit breaker is on the wall nearest the transformer. In the transformer chamber at a sub-basement level in South Africa House all the equipment, except the low-voltage link and fuse gear, is aligned from front to back, the room being long and narrow. In the Adam Street transformer chamber, a room of rather limited dimensions and irregular shape approached from a narrow court area, a very good lay-out has been designed. The ring-main unit has two circuit breakers, one for the transformer and one for an incoming trunk feeder to the ring main.



In one of the arched cellars of Somerset House every opportunity has been taken to afford an excellent lay-out with the high-voltage ring-main unit on one side and all the other equipments on the other side. Top-entry cables from the low-voltage distribution equipment are a very good feature here. In an Admiralty multiple-unit 1,000-kVA transformer chamber there is ample floor space, but the chamber is extremely irregular. The installation engineers have made a very good job of it all the same. In this case the ring-main

equipment has three circuit breakers, two to the transformers and one for an incoming trunk feeder. A transformer chamber at 56, Victoria Street, typifies what has become known as a "coal-cellar" development. Considerable use is being made of these under-pavement cellars in this way, and they often solve accommodation difficulties. In Grosvenor Gardens there is an example of one of the few opportunities to erect a sub-station building. It is of standard capacity and has an outdoor transformer, all in the court area of what was no doubt originally a residential dwelling.

We have already indicated that the area is overlaid with a symmetrical grid operated at the consumers' voltage, and a further quotation from Mr. Leach's paper will afford sufficient reference to the low-voltage distribution for the purposes of this article. "The l.v. network is so designed as to provide stand-by for the load at each distribution transformer chamber, and it is connected and operated in "solid" blocks of approximately 3,000 kVA capacity, each fed from one h.v. feeder and interconnected with fuses in groups totalling 12,000 kVA." This interlinking with fuses is effected generally in street link boxes, so far as is practicable at points where the least transfer of load takes place under normal conditions.

We are indebted to the Central London Electricity, Ltd., for permission to carry out our investigation and publish this article, and to the engineer-in-chief, Mr. J. W. Leach, for the co-operation of his staff in helping us to obtain the required information and take photographs.

Wallasey Jubilee

Fifty Years of Public Service

ON January 29th, 1897, the Wallasey Council's first generating station comprising two 75-kW, 2,000-V alternators direct coupled to Browett Lindley vertical compound condensing engines was formally inaugurated. On Wednesday last week the remarkable progress of the electricity undertaking in the fifty years which have followed were celebrated by a luncheon, a visit to the power station and the main substation (where the original generating plant was installed), and a dinner. At a reception which preceded the dinner the guests were welcomed by the Mayor and Mayoress (Alderman and Mrs. B. G. King), the chairman of the Electricity Committee, Alderman J. L. Gill, and Mrs. Gill.

Congratulating the undertaking on its achievements, Sir John Kennedy, deputy-chairman of the Electricity Commission, spoke of the enormous advance in the scientific way of living which electricity had brought to the majority of people. During the past fifty years the thermal efficiency of generating stations had improved from under 10 per cent to up to 30 per cent in the most efficient plant. Coal was being burnt smokelessly and without the emission of dust and fumes, and the use of electricity had curtailed the use of coal in house and office and had improved conditions of living. We must not, however, be complacent about these advances. There was no limit to what electricity could do and there was no prospect of saturation in the development of electricity during our lifetime.

Wallasey had a good record of steady advance and achievement. At the end of twenty-five years it had 6,700 consumers and was selling electricity at a rate of 10 million kWh a year: after the second twenty-five years it had 27,000 consumers, using 40 million kWh annually. With a population of 97,000, this showed a high degree of saturation but there was still plenty of room for expansion since the average consumption per head of population was only 400 kWh, compared with the national average of 700 kWh. Competition with the gas industry was healthy and the Government should not attempt to decide which service should be adopted. There was a definite public opinion in favour of electricity for domestic purposes.

If the Electricity Bill was passed as it stood the Town Council would have no further interest in the electrical wellbeing of the inhabitants. Efforts should be made to secure amendments which would ensure that local interest was maintained when the Area Board was set up. All those engaged in the electricity supply industry, especially those owning selected stations, realized how unreal had become the hypothetical costs, and from that point of view the divorcement of generation from distribution was very desirable. There was wide agreement upon the necessity for combining urban and rural supply areas, but many thought that the proposed number of Area Boards (fourteen) was too small.

Councillor H. R. Allison, vice-chairman of the Electricity Committee, stated that the undertaking had assets amounting to £1,000,000 and had reduced the average price of electricity sold from 5·38d. to 1·37d. The success of the industry had been due to the close contact with consumers, which municipal authorities were able to give. Undertakings would expect reasonably generous compensation under the Electricity Bill for the loss of their undertakings

and would resent anything approaching spoliation. Injustices would have to be righted in later years.

Questioning the necessity for interfering with the supply industry, Alderman Sir William Walker (Manchester) declared that, whatever the ownership, it would prosper, for this was an electrical age. A "lot of nonsence" was talked about rural supplies; only extremely small areas and an extremely small proportion of the population were not supplied. It was wrong that people living in high rated areas should subsidize low rated areas. With regard to the various electrical organizations such as the British Electrical Development Association, the Incorporated Municipal Electrical Association and the Electrical Research Association, it was difficult to see how they were to be fitted into the nationalization scheme but he thought that these bodies which had done so much good should not be lost.

Manchester electricity undertaking had assets totalling £16½ million, and a debt of £6 million. Was the latter figure all it was going to get under the Bill? There was much in the Bill which had not been thought out. Was there, for instance, to be no set-off for income tax on account of the assets of the electricity undertaking, and what was the position in regard to town halls built largely to accommodate electricity departments?

The worst feature of the Bill, however, was its emphasis on Civil Service control. If those appointed to run the industry were not allowed to exercise their own judgment and had to refer everything to Whitehall the industry would be put back a generation. There was no mention in the Bill of the appointment to the Board of people who had experience in the industry. Sir William asked for backing for the efforts, which the I.M.E.A. Council would announce at a meeting to be held this month, to secure amendments to the Bill. They must be unanimous and strong, he said, to see that the Bill emerged fair to local authorities.

Thanking Wallasey for its long support of the I.M.E.A. Mr. J. S. Pickles, president of the Association, added his plea to Sir William's for support for finding local authorities a better place in the Bill and so ensure that the nationalization scheme would be able to get off to a better start.

Alderman Mrs. Gregory, representing the Electrical Association for Women, said that women were looking to the industry, whoever owned it, to continue to extend the uses of electricity. Mr. C. T. S. Arnett (C.E.B.) asked all those who had any influence with Members of Parliament to urge them to see that generating plant was treated as guns were during the war in the matter of labour supplies.

Five electrical engineers and managers can claim to share in the development of the undertaking during its fifty years' existence. The first, Mr. J. H. Crowther, was succeeded in 1903 by Mr. J. A. Crowther. In 1921 Mr. B. T. Hawkins was appointed and served for twenty-four years. Mr. R. C. Golding then held the position for a year until the present engineer, Mr. W. J. Forster, took over last summer.

Hull and the Bill

The Consumers' Point of View

IN the opinion of Mr. D. Bellamy, O.B.E., D.L., general manager of the Hull Electricity Department, the effects of the new Electricity Bill should be looked at from the consumers' point of view. A report which he has prepared for his Committee, regarding the matter of compensation for municipal undertakings from this aspect, suggests that the arrangement is reasonable. Any additional compensation would merely add to the financial obligations of the new authority which would be reflected in the costs of electricity. Thus the consumer would be called upon to pay something quite extraneous to electricity supply costs. Mr. Bellamy produces a comparative table showing that Hull's policy of cheapening electricity instead of contributing sums for the relief of the local rates has greatly benefited the consumers.

It is considered that as the 1926 Act protected owners of selected stations from increased costs so the new measure should guarantee the consumers served by efficient undertakings from higher charges.

By way of income tax "set-off" the Hull Corporation has benefited by the profits of the electricity undertaking which have been chargeable to tax. Any compensation for this, however, obviously cannot be another charge upon electricity finances.

In the past the undertaking has paid a proportion of the central establishment charges. It is not thought that the loss of this will be serious as there are many new activities which will absorb any staff displaced from purely electrical duties. There appears to be no reason to assume that the Corporation will suffer any loss by reduction of rating assessment.

Loan Repayments and Sinking Funds

In an addendum to the report Mr. Bellamy amplifies his statements. He points out, *inter alia*, that loan repayments and sinking funds are in the nature of provision against depreciation and that the difference between total capital outlay and outstanding debt is equivalent to normal depreciation. Therefore, any writing back into liabilities of this difference must involve the duplicate payment by the consumer of the artificial costs so created.

Views on the News

Reflections on Current Topics

THOSE who listened to the recent broadcast performance of Shaw's *The Apple Cart* (written in 1929) will have been amused by the appropriateness at the present time of several passages. There is one in which Lysistrata says:—

"Here am I the Powermistress Royal. I have to organize and administer all the motor power in the country for the good of the country. I have to harness the winds and the tides, the oils and the coal seams. I have to see that every little sewing machine in the Hebrides, every dentist's drill in Shetland, every carpet sweeper in Margate has its stream of driving power from a switch in the wall." The Powermistress Royal also remarks:—

"My department was perfectly able and willing to deal with the supply of power from the tides in the North of Scotland, and you gave it away, like the boobs you are, to the Pentland Firth Syndicate."

* * *

It cannot be said that our present power controllers are not taking their own medicine. I hear that a prominent member of the Central Electricity Board (and no doubt other members) has recently suffered from prolonged "cuts." During the inquiry at Brighton into the Southwick power station proposals by the Ministry of Town and Country Planning and the Electricity Commissioners there was a cessation of supply which necessitated continuing the proceedings by candle light.

* * *

Punch published last week a drawing of a power station interior (of rather fanciful design, the steam apparently going into the generator) with two operators standing by the sets. Says one of these gentlemen to the other "How about cutting it off for twenty minutes and popping out for a coffee?"

* * *

As I have on a number of occasions regretted that it was possible for landlords of certain premises to "retail" electricity to their tenants at exorbitant prices, I am glad to see a remedy suggested by the Incorporated Municipal Electrical Association. It is pointed out that Section 18 of the Gasworks Clauses Act, 1847, incorporated in the Electric Lighting Act, 1882, provides that every person who shall supply any other person with any part of the gas or electricity supplied to him by the undertakers shall forfeit to the undertakers the sum of £5 and £2 a day for every day such pipe (or cable, presumably) shall so remain.

* * *

It is reported that one undertaking has successfully dealt with refractory landlords by charging them with the cost of vertical distributors to the tenants' premises in cases where the landlords have refused to allow the tenants the fullest use of electricity by providing an adequate installation. But I cannot see that this gets over the point of extortionate charges.

* * *

My inability to answer from personal observation a query concerning the suitability of fluorescent tubes for lighting billiard tables is excusable only by reference to the Spencerian quip that related proficiency in the game to a mis-spent youth. My interrogator presumably had in mind not what he called "stroboscopic effect" (which occurs only with moving machinery and is eliminated by supplying lamps from more than one phase) but cyclic flicker. That is smoothed out by persistence of vision and is much less than is produced by a seemingly steady cinema film which, I believe, runs through 16 or 24 frames a second with darkness between, as against 100 per second at 50 cycles for electric lamps that retain considerable residual light, even at points of zero current. Any noticeable flicker is therefore caused by shortcomings of individual lamps.

* * *

For some years the functions of the Batti-Wallahs' Society have been graced by "port" and "starboard" lanterns, indicating the "watches" into which the gatherings are divided. At last week's luncheon the lanterns were missing and Mr. Mark Whitgift, the Batti-Wallahs' hon. secretary, explained that as they were held to constitute "decorative" lighting they had had to be removed. In spite of this relief electricity supply was cut off for several hours on the day in question.

—REFLECTOR.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Motor Protection

IN his article on "Motor Control" in your issue of January 17th, "Rotor" states: "On larger switches the magnetic overload trips are often fed by current transformers, the time lag being provided by fuses which are connected across the trip coils."

This form of protection in my opinion is undesirable, since fuses are apt to deteriorate and there is always the risk of the wrong rating of fuse being inserted if an original-size replacement is not at hand. In any case, quick action is usually required to get the machine running again and, if the overload trips are not provided with adjustable calibration tubes, the overload coils must at least be shorted by a wire rated to blow above the normal full current of the trip coil. For general purposes, excluding power station auxiliaries where questions of discrimination and low currents at high voltages are met, together with high breaking capacity, which necessitate current transformers of restricted output and relays for protection, solenoid overload relays with oil dashpots for either squirrel-cage or slip-ring motors are better than time limit fuses.

Birmingham. H. T. STRATTON.

Motor Control

IN your issue of January 24th, Mr. A. N. D. Kerr implies that B.S. 168 is under revision and that the basis of rating will be changed from the load-plus-overload to continuous maximum rating, and in this connection he refers to a B.E.A.M.A. decision, as reported in your issue of April 26th last.

We think it right to point out that the report referred to stated that consideration was being given to the *desirability* of changing the basis of rating. At that time no decision had been taken to make such a change, and this is still the position to-day.

J. F. STANLEY,
London, S.W. 1. For the Director,
British Standards Institution.

Our Export Position

Potential American Competition

ADDRESSING the Liverpool Branch of the Institute of Export recently on the country's export position, Mr. L. Gamage (president) said that from time to time exporters had been told that they should direct their exports to "hard currency" countries. It seemed to be assumed that any exporter could switch his products almost at will from one overseas country to another. This was, in fact, difficult to do, as the finding of export business depended as a rule on long previous cultivation of the market. Quite apart from this, exports could only flow when there was a willing buyer as well as a willing seller.

The time was approaching when we should have to face severe competition. American industry, undamaged by war, was pouring the bulk of her merchandise into the domestic market whose pent-up purchasing power was rapidly expending itself. The overflow of American production directed to export markets was at present a trickle, but would all too soon become a torrent in which we would find ourselves desperately striving to retain our balance.

Although some of our present troubles were the outcome of the war, a large part of our misfortunes was of our own making, and in the realization of this lay the only hope of salvation. The first step in the change of heart necessary for our future welfare was the need for this national realization that in spite of all the difficulties we could overcome them only if we put them in their proper perspective. Then would appear a new spirit which would automatically bring in its train the will to work and the need for self-discipline. We might not be able to compete with America in quantity production of identical products, where we should find ourselves at some disadvantage in speed of output and cost, but in the export market versatility was an important factor, and in this field no one could beat us.

Canadian Electrical Exports and Imports

Canadian exports of electrical goods during the nine months ended September last amounted in value to $16,947,000, as compared with $55,405,000 during the corresponding period of 1945. About half consisted of radio apparatus. During the same period Canadian imports of electrical goods totalled $33,625,000 in value, as compared with $34,171,000, with radio apparatus at $7,860,000 ($13,677,000).

Electricity Nationalization

Second Reading of Bill

THE two-day debate in the House of Commons on the Electricity Bill was opened on Monday last by the Minister of Fuel and Power who moved the second reading. Mr. Shinwell said that in 1942 the Coalition Government set up the Ministry of Fuel and Power, one of the functions of which was to secure the effective and co-ordinated development of coal and to promote economy and efficiency in the supply, distribution, use and consumption of fuel and power. The Labour Government had nationalized the coal industry and obviously the next stage was to take appropriate measures to reorganize the electricity industry. The supply of electricity and, in particular, its distribution, was at present organized on a basis which must be regarded as completely out of date. In due course, the gas industry would come under review and an appropriate measure for reorganization would be introduced into Parliament.

Need for Reorganization

After outlining the history of legislation affecting the electricity supply industry he submitted that whatever Government had assumed office in July, 1945, would have been compelled to introduce long-overdue legislation to reorganize the distribution side of the industry. He had been impressed with the fact that the various sections of the electricity supply industry had found it impossible to reconcile their differences.

For many years there had been constant complaints of the extraordinary variety of charges in electricity supply and the basis on which those charges were fixed was often obscure. He was satisfied that this public service must do everything possible to rationalize its method of charging. That was not possible so long as there were 563 undertakings each possessing rights in its own area. Not only must the method of charging be standardized but also the supply itself. It was true that progress was being made, but it was much too slow and there was no obvious inducement to undertakings to incur substantial expenditure in standardizing their systems. Standardization could only be effected by undertakings operating over wide areas with adequate resources and with far-reaching plans for development.

The great number of undertakings also led to excessive variety in other respects. Different undertakings had different ideas as to the type and design of their appliances or the plant they required. Engineers displayed a great divergence of views in the design of plant and that meant that sometimes the variety of tastes was expensive. In the end it was the consumer who had to pay.

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The Bill provided that the British Electricity Authority should have full responsibility for the generation of electricity and its sale in bulk for public supply, but to maintain the closest contact with local requirements together with a sense of local responsibility there would be fourteen Area Boards the boundaries of which he had indicated in the White Paper issued with the Bill. The British Electricity Authority would be responsible for the general policy affecting distribution and would be the sole body in the industry with powers to raise capital. It was proposed, however, that the Area Boards should, within limits, have freedom to carry on their detailed work without reference to the Central Authority. He regarded them as autonomous bodies and for that reason he proposed to appoint them himself.

It was essential that the Area Boards and the Central Authority should learn to understand each other and work in the closest co-operation. The Bill therefore provided that four chairmen of Area Boards would be appointed as members of the Central Authority, this membership moving in rotation among the chairmen. That would lead to unity of interest between the Central Authority and the Area Boards.

Manufacture of Equipment

One of the criticisms of the Bill was that the Central Authority would have power to manufacture electrical plant and fittings and that they and the Area Boards would have the power to sell, hire or install electrical fittings. But at present many private companies in the industry, such as the County of London Electric Supply Co. and the North Eastern Electric Supply Co., had power in their articles of association to manufacture plant or fittings and he regarded it as the right policy to give to their successors similar powers. He understood that the companies had not exercised these powers, but while they had not done so directly, there had been a close connection between the supply and the manufacturing sides of the electrical industry. The device of interlocking directorates was quite well known. For example, the managing director of Edmundsons was on the board of the English Electric Co. The chairman of Babcock & Wilcox was on the board of the Power Securities Corporation which controlled many electricity supply companies both here and abroad.

Furthermore, firms engaged in the manufacture of electrical plant and fittings had purchased controlling rights in supply companies and had become themselves holding companies. For example, that had been done by some cable-making companies and the General Electric Co. It was not surprising, therefore,

that the electricity supply companies had not engaged in the manufacture of electrical plant and appliances. It might be that there were special arrangements between the supply companies and the manufacturing companies which were not always disclosed to the public.

Moreover, it was essential that the new Boards should be vested with power to manufacture plant. Otherwise, they might encounter difficulties in obtaining reasonably satisfactory terms from the existing manufacturers. Equally, the selling and installation of electrical appliances was an essential part of the work of the Boards.

Position of Electrical Contractors

Many of the existing undertakings had developed on a wide scale the supply and installation of appliances. The Electricity Boards would afford these facilities and would also service the appliances when installed. He expected that the Boards would develop schemes of assisted wiring which were usually outside the range of electrical contractors' functions.

The great expansion of electricity which would emerge from the activities of the Boards would assist electrical contractors in various ways and if there were firms who wished to co-operate with the Boards by acting as their agents or by undertaking the work of installation, there was no reason why they should not enter into agreements for that purpose.

The Boards would only sell or install appliances of the best quality. At present the shops had far too many shoddy electrical appliances which were both inefficient and expensive and, in many cases, unsafe. The Boards, as public corporations, would have every inducement to sell the best appliances and they would be able, as large purchasers, to raise the standard of these appliances so that the consumer could be assured of the best value. Most of the members of the Consultative Councils would be nominated by the local authorities and other members by representative associations including trade unions. The Councils would be associated with the work of the Area Boards, be advised of their plans and would examine these plans in the light of their knowledge of local interests and requirements.

Turning to the subject of compensation for the acquisition of assets of electricity undertakings, Mr. Shinwell said he had come to the conclusion that the only possible method of compensation to be adopted was the one embodied in the Bill. That method was not only practicable but fair and even generous. The future of the companies was uncertain in view of the existence of local authorities' rights, and the Government would probably be compelled to introduce legislation which would affect the future level of companies' profits. The companies themselves had been fully aware of this possibility.

Many companies had adopted the practice of issuing their existing shareholders with new shares at prices below the prevailing market value. In some cases, the existing shareholders were largely, if not entirely, the holding company which controlled the company in question, so that the holding company was simply manipulating the issue of new shares to line its own pockets. There were many other ways in which holding companies could make undue profits in their transactions with their subsidiaries.

In all the circumstances, compensation on the basis of market value must be regarded as generous. Some limitation of the profits taken from the electricity consumer was long overdue and the companies were uneasily aware of that probability. It was not unreasonable, therefore, that compensation should entail a reduced income to the existing shareholder; otherwise the Government would have found it necessary to propose a scaling down of market value.

About £400 million would be required (he concluded) for improving the distribution network, and a substantial proportion of that would be used in the development of supplies to the countryside. The new Boards would be able to undertake rural development on a national and systematic plan, and unless it was proceeded with quickly, he was satisfied there was no hope of checking the decline in the rural population. In agriculture, electric power could play as great a part as it could in industry and with the shortage of manpower in agriculture, intensified electrification was imperative.

The private companies had made great play with the suggestion contained in the McGowan Report " that a scheme of complete reorganization which would involve the vesting of all electricity undertakings in a number of Regional Boards must result in a serious and unnecessary dislocation of the supply industry." Should development schemes be arrested it would not be due to national ownership but to the difficulty in providing sufficient plant and labour. But the Government would make every effort to expedite development plans and also promote the speedy production of generating plant.

Motion for Rejection

The rejection was moved, on behalf of the Opposition, by Mr. R. S. Hudson, who said that Mr. Shinwell could not have chosen a worse moment to precipitate a dislocation of the industry. The interest of the consumer was to get cheap and abundant supplies of electricity, with good service, and no undue preference between one consumer and another. In this respect the policy to be followed by the new authority was found set out in a series of platitudinous, pious wishes in Clause 1 (6). Statutory undertakers were already under an obligation to supply cheap and abundant electricity, but here the phrase " cheap and abundant " had been wisely dropped in favour of " the cheapening so far as practicable " of

electricity. The avoidance of undue preference in the provision of supplies was also promised, but that was the law now, and the present statutory safeguards against it were being destroyed by the repeal of an earlier Act.

Clause 43 enabled the new Authority to supply electricity to railways. At present the Central Electricity Board could supply electricity to railways but only so long as it was not done at a loss. That very important safeguard had been eliminated and it would be open to the Electricity Authority in future to subsidize nationalized railways.

There was a complete absence of any protection for the consumer in the Bill. Tariffs were being left to the decision of the Area Boards, leaving the consumer completely at their mercy. A good deal more faith would be held in the efficacy of the Consultative Councils if they had any effective executive power and were appointed by outside bodies. In the past the competition of gas and electricity had had the effect of cheapening both services. If the Government took over gas undertakings one more safeguard against rises in the price of electricity would be taken away.

Would rural charges be brought into line with local charges, and what was the Minister going to spend on rural electricity? Was he going to abolish installation charges, and was the Government going to give special priority to electricity in rural areas? The Minister did not know the answer to any of these questions.

Minister's Wide Powers

The Opposition took exception to the Minister's being able to appoint Consultative Councils, as this was incompatible with what the Minister had said about consumers' requirements. The Bill gave the Minister wide and arbitrary powers and there was no appeal from his decisions. This was contrary to natural justice and constitutional practice.

In regard to compensation, at any given moment it did not follow automatically that the value of shares quoted on the Stock Exchange accurately reflected the real value of all the assets of a company. A young progressive company in a developing area had to spend a very large amount of capital on development which would not come to fruition for six or even ten years. Clearly such a company would not be able to pay a large dividend and therefore its shares would stand at a low quotation. But a company whose capital was already bearing fruit could legitimately pay a high dividend to compensate its shareholders for a lack of dividends in earlier years and as a result its shares would stand higher and its compensation would be greater. Moreover, electricity shares stood higher in the pre-election period than later and therefore the pre-election period would be chosen. That meant that the Chancellor of the Exchequer proposed to pay shareholders pre-election Stock Exchange quotations in depreciated currency. In the case of a local authority which had a debt, under the Bill the State would pay the debt and the authority would lose the undertaking, while without the Bill the debt would still be discharged and the municipality would retain the undertaking—which meant ratepayers would get a raw deal.

The Bill dismissed directors without compensation. Apart from this being a petty example of class warfare, electricity happened to be an industry where directors could legitimately point with pride to what they had achieved. The Minister was jettisoning the whole of their experience. The Bill was one more example of the Government's passion for over-centralization. Not only was it an attack on a decentralized industry but two-thirds of it was an attack on non-profit-making local authority enterprise. Many of its provisions were grossly unfair and unjust to large numbers of people connected with the industry.

In the debate which followed, the Bill was roundly condemned by Col. Lancaster, who, speaking as an industrialist who used between 15,000,000 and 20,000,000 kWh per annum, said that he had in the past had certain safeguards regarding supply and price which were wholly swept away by the Bill. As a consumer he had had nothing to complain about regarding electricity supply. He wished to see many of the proposals carried out but he was opposed to the whole conception of centralizing authority.

Mr. Palmer, the Labour member for Wimbledon, said that the Bill was long overdue. While he would agree that some of the companies had done fairly valuable work in the development of electricity—it would be unfair not to say so—they had taken a very handsome profit in return.

Scottish Member's Criticisms

The Secretary of State for Scotland (Mr. Westwood) explained how the Bill affected the North of Scotland Hydro-Electric Board.

Commander Galbraith protested against the division of Scotland into three parts, which would make Southern Scotland into "two English provinces." He pointed out that electricity was cheaper in Scotland than in England. Taking the country as a whole, English prices were 25 per cent higher than those in Scotland and 12½ per cent higher than those in the South of Scotland. If common tariffs were introduced it would mean an automatic and immediate increase in the cost of electricity in the South of Scotland.

Liberal Party support for the Bill was announced by Mr. Wadsworth, who urged that there should be no delay in establishing additional generating stations.

Mr. Blyton, Col. Clarke, Mr. Hobson, Mr. G. Williams, Mr. E. Porter, Lt. Col. Sir Thomas Moore, Mr. Cook, Col. Crosthwaite-Eyre, Mr. Goodrich, Mr. N. Birch, and Mr. G. Jeger and Viscount Hinchingbrooke continued the debate.

When the debate was resumed on Tuesday, Sir Arnold Gridley, speaking as one who had been actively engaged in the industry for nearly fifty years, said that it had put up a performance surpassed by none. He did not say that there were no improvements which might be made. One defect was the large number of small undertakings, owing to the mistakes of past Parliaments. Another was the overlapping of d.c. and a.c. systems with various voltages. There were also complaints about variation of tariffs, but with some rearrangement of the industry and a small number of large areas, that problem would practically solve itself. Notwithstanding minor defects the industry had shown most remarkable expansion, both commercially and technically. No arguments advanced in support of the Bill showed the slightest justification for nationalizing an industry which was already so largely under public ownership and control. The Bill contained grossly unfair compensation proposals.

"Thoroughly Bad Bill"

In the powers which it sought, the Bill was entirely *ultra vires* the Government's electricity mandate. The Government asked the House to accept a plan which was utterly at variance with expert advice given in reports by Government committees. Whatever test was applied it was a thoroughly bad Bill. Furthermore the development of atomic energy might make them all look foolish in having agreed that the State should spend hundreds of millions of pounds in acquiring an industry when much of what was acquired might be wasted. The Bill would do nothing to further the national interest and might do it irreparable harm.

Mr. Walter Elliott, from the Opposition front bench, also condemned the Bill. He said that in particular the destruction of the great municipal electricity undertakings was a retrograde and not a progressive step. After a reference to the widely different terms on which the Glasgow and Birmingham undertakings would be acquired, Mr. Elliott said that the new Electricity Authority would not be complete until the Minister had made twenty-four Regulations, examined 500 Provisional and Special Orders and 200 special Acts, and had considered whether these provisions were not inconsistent with or were redundant under the new Act. Seven hundred statutory enactments had to be extended or repealed before uniformity was achieved. Legislation had not been codified, it had been "assassinated."

Mr. Turner-Samuels said that Parliament could not administer electricity. That was a job for the Minister and his departments. Mr. P. Roberts said that no evidence had been produced to show that any benefits would be obtained by change of ownership. No proper arguments had yet been put forward to show why the taxpayer should be asked to pay a sum of upwards of £2,000 million in order to effect rationalization of the industry.

Mr. Burden, a Labour member, said that the Bill proposed somewhat cavalier treatment for local authorities. Their undertakings were to be taken over on terms that the Minister would not dare to propose for private enterprise. The Minister should ensure that members of local authorities now owning electricity undertakings were appointed on the Area Boards as of right and thus maintain direct representation between the community and the governing body of the industry. Other Labour members expressed anxiety about the position of local authority undertakings.

Mr. Pickthorn, Mr. J. Lewis, Col. Hutchison, Major Wise, Mr. Boyd-Carpenter and Mr. H. Roberts also spoke.

Mr. Raikes, winding up for the Opposition, said that the Bill struck a bitter blow to municipal enterprise and ratepayers would be faced with certain loss.

Mr. Gaitskell, Parliamentary Secretary, Ministry of Fuel and Power, said that provision was made for representation of local authorities on the Consultative Councils. The Joint Industrial Councils in the electricity industry would continue and the trade unions were satisfied with the proposals. The alternative proposals put forward by the Opposition were merely designed to avoid clashing with vested interests. That was not a satisfactory basis on which to establish an efficient industry.

The motion for the rejection of the Bill was negatived by 340 to 165—Government majority 175, and the Bill was read a second time.

A motion to commit the measure to a Committee of the whole House (moved by Mr. R. S. Hudson) was rejected and the Bill will therefore go to a Standing Committee in due course. The necessary Money Resolution authorizing a sum of £700 million was also passed, an amendment by Mr. Hudson to reduce the amount to £400 million being negatived.

Staff Dinner

THE first post-war staff dinner of the J. L. Eve Construction Co., Ltd., was held last Monday at Simpson's. Mr. J. L. Eve, chairman of the company, presided over a gathering of more than fifty, which included twenty-three of the original staff of thirty-three with which the undertaking started seventeen years ago and four of their sons. In a brief review of progress, he mentioned the firm's activities during the war, which included most of the radar towers, a considerable proportion of those for the grid extensions and work in connection with "Pluto," to the value of £3 million. At present important contracts were being carried out for electric power transmission in Scotland. On behalf of the staff, Mr. Gerald Ames (secretary) presented Mr. Eve (whose own diamond jubilee was on that day) with an inscribed gold half-hunter watch to which Miss Garner added a signed illuminated address.

PERSONAL and SOCIAL

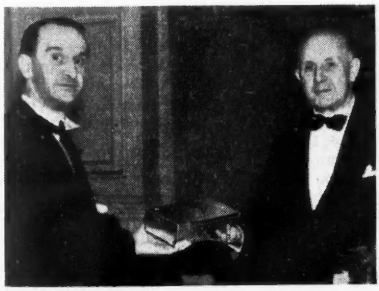
News of Men and Women of the Industry

THE Cheltenham Corporation Electricity Committee has appointed **Mr. K. W. Finch,** B.Sc., A.M.I.E.E., A.C.I.S., to be deputy borough electrical engineer and manager. Mr. Finch was educated at Edward VI School, Norwich, and received his technical training as an articled pupil under the late Mr. F. M. Long in the Norwich Electricity Department, and at Norwich City College. After serving three years as junior mains engineer, he was promoted to the position of high-voltage distribution engineer, a post which he held until the outbreak of war, when he was called up for service with the Navy as sub-lieutenant, becoming later lieutenant, R.N.V.R. After being demobilized in 1945 Mr. Finch returned to Norwich as assistant planning and development superintendent, and last year he was promoted to senior technical assistant.

Mr. K. W. Finch

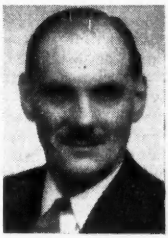
Mr. J. Billcliff, A.M.I.E.E. deputy mains engineer and technical assistant in the Cheltenham electricity undertaking, has been promoted to technical assistant under a reorganization scheme for the distribution department. Mr. Billcliff, who was a pupil under Mr. J. P. Simpson at Preston, held the positions of junior mains engineer and mains assistant at Preston. In 1938 he was appointed to the mains staff at Eastbourne and later was promoted to senior assistant mains engineer, which post he held until 1944, when he obtained his present appointment at Cheltenham.

During the managers' sales conference of Electrical Components, Ltd., held at the Grand Hotel, Birmingham, from January 21st to 23rd, **Mr. H. S. Seccombe,** chairman and managing director of the company was presented by the staff with a handsome silver casket to commemorate the completion of twenty-five years as managing director. The casket was engraved with the facsimile signatures of sixty members of the staff who had, themselves, been in the company's employ for periods of ten years or more. The presentation was made at a dinner held at the hotel on January 22nd. The accompanying picture shows Mr. L. Wall, Birmingham branch manager (the oldest employee of the company) making the presentation to Mr. Seccombe.



Presentation to Mr. H. S. Seccombe, chairman and managing director of Electrical Components, Ltd.

Mr. S. Broughton, A.C.A., has been appointed managing director of Electrolux, Ltd., in succession to **Mr. J. Scrivener,** the present vice-chairman. Mr. Broughton, who has been associated with Electrolux, Ltd., for twenty years, joined the staff in 1933, but before that he was on the staff of the company's auditors as a chartered accountant, he has officiated as controller of the internal audit and hire-purchase accounts, assistant to the managing director, manager of export sales, assistant secretary and secretary. The new secretary of the company will be **Mr. M. Aitken,** F.C.I.S,. who has been with the company for over twenty years.



Mr. S. Broughton

Mr. W. L. Tregoning, who was recently appointed a joint managing director of the Jackson Electric Stove Co., Ltd., has been released for a period of twelve months to the Government to take up a senior executive position with the Control Commission in Germany.

Lord Westwood, O.B.E., has been appointed chairman of Neale & Partners, Ltd., electrical contractors, of Newcastle-upon-Tyne and Edinburgh. **Mr. C. H. Neale** will continue to act as managing director.

Mr. H. S. Hind has been re-elected president of the Northampton Engineering College Past Students' Association ("Old N'ions") for the ensuing year. **Mr. J. Mortimer Hawkins** has succeeded Mr. C. E. Smith as hon. secretary and treasurer, while **Mr. A. N. D. Kerr** continues as hon. editor.

Mr. T. Eric E. Marsh, A.M.C.T., A.M.I.E.E., is to take up an appointment as electrical engineer to Mufuliva Copper Mines, Ltd., in Northern Rhodesia, and has resigned his post

as chief electrical engineer to Bickershaw Collieries, Ltd., Lancs. He received his training with the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, and Manchester College of Technology, specializing in the application of electricity to mining. He was an engineer in the mining section of Metropolitan-Vickers before being appointed to Bickershaw in 1937, and is vice-president of the North-Western Branch of the Association of Mining Electrical and Mechanical Engineers. A fountain pen and cash were presented to Mr. Marsh by the staff of the electrical department of Bickershaw Collieries.

Mr. H. Harrison, deputy borough electrical engineer of Tynemouth, has been appointed borough electrical engineer in succession to **Mr. J. B. Glen,** who has retired.

Mr. W. B. Bamford, assistant to the late Mr. W. Wood, who was for twenty-four years in charge of the non-ferrous metals branch of Thos. W. Ward, Ltd., Sheffield, has been placed in control of the department. His chief assistant will be **Mr. H. Bunker,** who for the past five years has handled the company's non-ferrous metals operations in Birmingham and the Midlands. Mr. Bunker is succeeded in this latter area by **Mr. H. S. Rippon,** who will operate from the company's Birmingham office.

Mr. H. Bradshaw, A.M.I.E.E., A.M.I.Mech.E., has sailed for Cyprus to take up an appointment with the Nicosia Electric Power Co. Mr. Bradshaw, who served his articles with a former Burnley electrical engineer, Mr. J. E. Starkie, was appointed mains engineer to Southport Corporation in 1938. During the war he attained the rank of lieut.-cdr., R.N.V.R., and since demobilization he has been mains engineer with the West Gloucestershire Power Co.

The Bristol Corporation Electricity Department has recently appointed **Mr. W. H. Donald** to be mains transmission engineer. **Mr. G. E. Black** has been appointed shift control engineer at Portishead.

Mr. M. R. G. Paice, A.M.I.E.E., of Southampton, has now taken up the duties of sub-station engineer with the Barking Corporation Electricity Department.

Mr. W. G. S. Sexton, at present commercial assistant to the Litchfield electricity undertaking, has been appointed electricity accountant at Erith.

Mr. H. H. Aston has been appointed a director of the Simplex Electric Co., Ltd. He is general works manager of the company's new factory at Blythe Bridge, Staffs.

Dr. R. C. G. Williams, Ph.D., B.Sc., M.I.E.E., has joined the North American Philips Co., Inc., of New York, U.S.A., as an executive engineer. Dr. Williams went to America for the purpose of gaining experience in American industrial developments in the electrical and allied fields and to become acquainted with their manufacturing methods. Apart from the executive posts which Dr. Williams occupied while at Murphy Radio, Ltd., he will be remembered for his work on technical committees and for the interest that he always displayed in the Radio Section of the I.E.E.

Mr. W. Thomas, Wing Commander, R.A.F., late Air Staff Officer attached to the Air-Sea Rescue Directorate, has joined the staff of F. Perkins, Ltd., Peterborough.

Mr. P. C. Chinery, at present on the installation staff of the Hastings Corporation Electricity Department, has been appointed consumers' assistant with the Chichester Corporation electricity undertaking.

Mr. G. H. Warne, meter and test engineer with the London and Home Counties J.E.A., has been appointed meter engineer with the Walsall Corporation Electricity Department, and **Mr. S. C. Dinenage,** technical assistant in the sales department of the Birmingham electricity undertaking, has been appointed assistant consumers' engineer at Walsall.

Mr. A. V. Mathias has been appointed progress engineer with the Fulham Borough Council Electricity Department at a commencing salary of £627.

Mr. A. S. Trollip, C.I.E., J.P., B.Sc., retired as general manager of the Bombay Electric Supply & Tramways Co., Ltd., on December 31st, after twenty-seven years' service, and will shortly leave India for this country. He is succeeded by **Mr. A. L. Guilford,** J.P., B.Sc.Tech., M.I.E.E., formerly deputy general manager.

Mr. W. M. Ratcliffe has relinquished his position as managing director of Heenan & Froude, Ltd., on medical advice, but will continue to serve as joint managing director with **Mr. F. J. Fielding,** who has been appointed to share the office. **Mr. A. H. Langford,** general manager of the company, and **Mr. R. V. Rowles** have been elected directors.

On January 25th nearly one hundred of the junior staff at the G.E.C. head office were the guests of the **Hon. Mrs. Gamage,** wife of Mr. L. Gamage, vice-chairman of the company, at her annual junior staff social. After an excellent meal in the G.E.C. canteen they were taken by coach to Olympia to see Bertram Mills' Circus.

Obituary

Mr. J. Foster-Smith.—We regret to announce the death, on January 24th, of Mr. James Foster-Smith, managing director of the Wellman Smith Owen Engineering Corporation, Ltd., since 1919, which occurred at his residence, "Kenton," Hillcrest Road, Ealing, after a short illness. Mr. Foster-Smith had been associated with the Wellman companies for forty years.

Capt. A. J. Mayne.—The death is announced at Runfold, Surrey, last Sunday of Capt. Arthur James Mayne, O.B.E., M.I.E.E.

Will.—Mr. J. L. Baird, the television pioneer, who died on June 14th last, left £7,370 gross, with net personalty £7,102.

PARLIAMENTARY NEWS

By Our Special Reporter

LAST week in the House of Commons Commander Galbraith asked the Minister of Fuel and Power what extra kW capacity would be available for the supply of electricity to Great Britain in the years 1949, 1950 and 1951, respectively; and whether he estimated that such increases in capacity would meet all estimated increases of electricity demand, together with a reasonable margin.

Mr. Shinwell said it was estimated that the additional generating capacity which would be available for the public supply of electricity would be 2,600,000 kW by the end of 1949, 4,460,000 kW by the end of 1950, and 5,660,000 kW by the end of 1951. These increases would not be sufficient to meet the increase of electricity demand until the winter of 1950-51, but should then be sufficient, provided certain obsolete plant was still kept in commission.

Plant out of Commission

Commander Galbraith asked the Minister how much electricity generating plant was usually out of action for maintenance and repair at present as compared with 1938; and what proportion of this resulted from the use of unsuitable coal.

Mr. Shinwell said that the loss in capacity of generating plant which was out of action on account of maintenance, repair, etc., at the present time was 14·7 per cent of the total capacity compared with 5·7 per cent in 1938. The loss due to unsuitable coal at the present time was calculated at 3 per cent.

Warnings of Cuts

Mr. Wyatt asked the Minister of Fuel and Power what warning was given to factories before a cut in the electricity supply was made.

Mr. Shinwell said that electricity undertakings gave warnings, whenever possible, to important industrial consumers, but owing to the time factor they could not give individual notice except to a few consumers. Broadcast warnings were issued immediately before the 7 a.m. and the 8 a.m. news on the Home Service programme. At other times of the day warnings were given in the Light programme as occasion demands, and these were picked up by factories on their radio sets.

North Metropolitan Stock

Sir J. Mellor asked the Chancellor of the Exchequer if he would quote the text of the Treasury's guarantee of the 5 per cent debenture stock, 1931–57, of the North Metropolitan Power Station Co., Ltd., and if he would give an assurance that the Government did not propose to impair this guarantee by legislation.

Mr. W. G. Hall, Financial Secretary to the Treasury, said that if the company was taken over under the Electricity Bill, compensation stock would be issued in exchange for this security. Such issue would not impair the guarantee.

Sir J. Mellor asked if the Financial Secretary meant that the default was no default when committed by Act of Parliament.

Mr. Hall said that the guarantee was against default by that particular company and it still held.

New Telephones

Mr. C. Smith asked the Assistant Postmaster-General what was the estimated aggregate number of outstanding applications for telephone service; at what rate new applications were being received; at what rate telephones were now being installed; at what date it was estimated that telephones would be installed immediately on application; and at what date it was anticipated that active canvassing would be resumed by his Department in connection with promotion of telephone sales.

Mr. Burke said that about 350,000 applications for telephone service were now outstanding. During the last six months of 1946, new applications were received at the rate of 72,000 a month, and telephones were provided at the rate of 65,000 a month, nearly double the pre-war rate of installation. The delay in the provision of telephones was largely the result of the cessation during the war of construction work for the public service. In view of the heavy demands on the national manufacturing and building resources, it was not possible at present to forecast when telephones would be supplied on application or when canvassing for orders would be resumed.

Electrical Components

Mr. Tomlinson, in reply to Major Roberts, gave the following figures showing stocks of electrical wiring accessories held by the Ministry of Works at January 1st, 1947:—

Item	*Stock*
Switches	157,416
Plugs	77,556
Sockets	40,498
Ceiling roses	100,711
¾-in. Metal conduit—feet	39,531
Flex—yds.	151,770

These stocks represented on the average three months' use.

R.A.F. Electricians

Mr. Lipson asked the Secretary of State for Air if he was now able to bring the release groups for electricians into line with those for other trades.

Mr. Noel-Baker said he was afraid they were still short of electricians and he could not forecast when these trades would come into line with the general level of release.

Braking Induction Motors

Regenerative, Reverse-Current and D.C.-Injection Methods

By B. Feltbower,
B.Sc., A.M.I.E.E.

THREE methods are in general use for the braking of a.c. induction motors, namely, regenerative, reverse-current and d.c.-injection. The first is operative only at speeds above synchronous and has therefore limited applications. The other two are frequently used on machine tools and other drives where quick stopping of the motor is essential.

Regenerative Braking

In regenerative braking kinetic energy is transformed into electrical energy and returned to the lines. This method is used where mechanical loads drive the motor under certain conditions, e.g., lowering a heavy load on a crane. The load is not to be braked to a standstill, but the speed of descent has to be controlled so that it does not exceed a safe limit.

When the motor runs slightly below synchronous speed, the currents in the rotor conductors, owing to induced e.m.f.'s, set up a magnetic field which induces an e.m.f. in the stator winding having a component in opposition to the line voltage. At synchronous speed no currents will flow in the rotor winding, but if the rotor is driven mechanically at speeds higher than the synchronous, currents will again flow, due to the stator field retaining its constant synchronous speed. These currents will produce a back-e.m.f. in the stator winding not in phase opposition to the line voltage and energy will be supplied to the lines. The frequency of the back-e.m.f. is independent of the rotor speed and is constant, controlled only by the frequency of the supply system which sets up the primary rotating field.

When increasing the speed from the normal by driving the rotor mechanically (but remaining below no-load speed) the motor will still produce a driving torque which, however, is reduced at small slips proportional to the slip and will draw energy from the lines. As synchronous speed is approached this available driving torque decreases and is zero at no-load speed, which is still below the synchronous speed. If the speed is further increased to slightly above synchronous speed (approximately 1 per cent positive slip) the motor will take in mechanical energy at the shaft and electrical energy from the lines so that, although developing a very small braking torque, it is not yet regenerating.

If the speed is again increased, however, the motor will start to regenerate, requiring a considerable mechanical torque to drive it. With full-load current flowing in the stator winding, this is in excess of the motoring torque corresponding to the same motoring-current value, because, when motoring, the stator copper and iron losses have to be provided from the mains and are deducted from the electrical rotor input, thus decreasing the available torque. When generating at super-synchronous speeds these losses have to be supplied mechanically to the rotor and thus increase the required torque.

Resistance in Rotor Circuit

Insertion of external resistance in the rotor circuit has the same effect on the speed-torque characteristic in the generating range as in the motoring range, i.e., it produces a lower braking torque with a lower current at a certain speed than would be the case without the external resistance (Fig. 1). This might lead to dangerously high speeds and for this reason wound-rotor induction motors are braked regeneratively with their slip-rings short-circuited.

Regenerative braking takes place automatically when pole-changing motors running at high speed are suddenly disconnected and switched over to low speed. Severe current rushes can be expected unless sufficient time is allowed for the motor to slow down before re-connection.

Protection against possible overheating of the motor due to high current during prolonged braking at excessive speeds is necessary, e.g., by applying a mechanical brake. If the load speed exceeds the speed at which maximum torque is developed, unstable conditions will be created, wherein a reduced braking torque will correspond to an increased speed and the motor will tend to run away.

Regenerative braking is applicable to any kind of induction motor and is usually employed in hoist and crane drives and also on mountainous electric main lines where long

descents have to be negotiated. Certain Italian Alpine lines on which the locomotives are driven by three-phase induction motors provide a good example.

Applications of Reverse-Current Braking

Reverse-current braking is generally used for small and medium squirrel-cage motors for machine-tool drives where quick stopping is required. It has, however, been used on much heavier equipment, e.g., calenders and mixing rolls. A feature of this method is the reversal of rotation of the motors, if not disconnected at the moment when standstill is reached. This is usually regarded as a disadvantage but has been made use of for the full-load torque (Fig. 1). Reversal is brought about by changing over the phase rotation of the stator supply by means of switches or contactors. At the moment of reversal of the field rotation, the rotor conductors will cut the field at a relative speed which is very nearly twice that obtained during starting, and the high e.m.f. thus induced will cause a heavy current to flow through the rotor winding where the generated energy will be dissipated as heat.

The stator current will also be very high, and will exceed the starting current. As the motor slows down the torque increases until at standstill the starting torque is reached. The insertion of external rotor resistance will

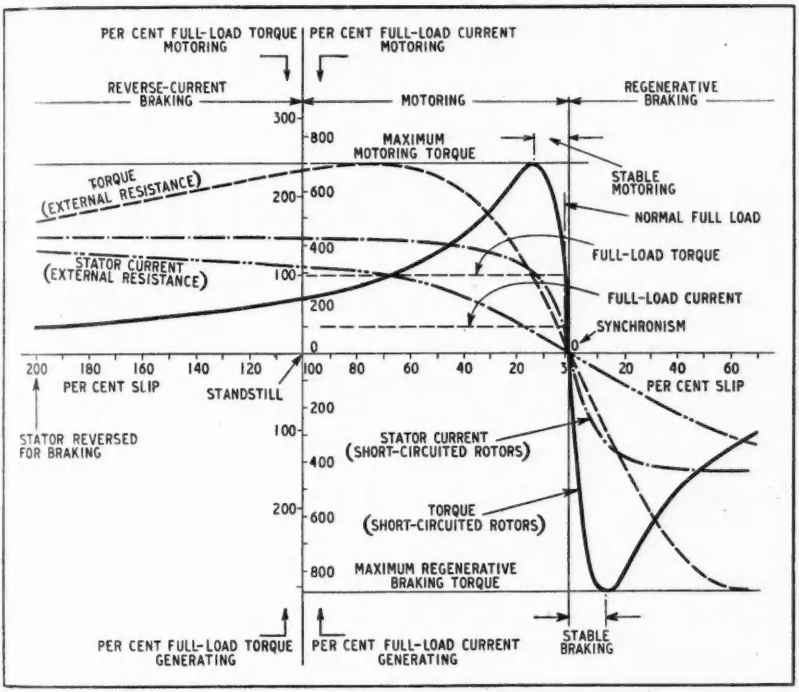


Fig. 1.—Motor characteristics

the protection of operators. Special tripping devices initiate reversal of rotation and rapid braking should the operator be caught and drawn towards the machine.

The braking torque when the rotation of the field is reversed and full voltage is applied to the stator supply is of the same order as decrease the current in both stator and rotor circuits, provide a higher average braking torque and permit part of the braking energy to be dissipated outside the motor frame. When braking wound-rotor induction motors in this way it is, therefore, advisable to re-insert all or part of the starting resistance.

Another method of decreasing the high current is by a reduction of the e.m.f. applied to the stator when braking, e.g., by inserting a resistance. This, however, also considerably decreases the available braking torque.

If frequent starting and stopping is required, in view of the high currents taken during these periods, the motor may have to be of a bigger frame size than would otherwise be necessary. Theoretically this braking method should bring the rotor to a standstill, at which point the supply should be disconnected; otherwise the motor will still start rotating in the opposite direction. In practice, however, the correct time of disconnecting the motor (which is only stationary for a moment) cannot be judged. It is therefore common practice to disconnect it just before it reaches standstill and to let it coast for the last few revolutions.

Various methods are in use for disconnecting the motor at the appropriate moment. If the operator can be relied upon, manual control may be sufficient, but this is not possible when automatic cycles of operation are required. Use is then made of friction switches (mechanical or magnetic), which disconnect the stator when the motor has reached standstill and just develops a tendency to start in the reverse direction, or of centrifugal switches which operate on or near standstill. The latter type can be used for brake control in both directions of rotation, a useful point when reversing starters are required.

A third method of controlling braking is by the application of time switches which are set to meet the individual cases and disconnect the motor after a constant time interval. This method suffers from the disadvantage that varying operating conditions (varying friction in particular) will prevent consistent results although this method is preferred because no extra connections are required between motor and starter and it is easily adapted to reversing duty. Reverse-current braking can be applied to two- and three-phase motors but not to ordinary single-phase motors.

D.C. Injection Method

In recent years d.c. injection braking has come into increasing use, not only for small motors on machine tools but also for big motors driving heavy machinery such as rolling mills, hoists, winders, etc. It is applicable not only to ordinary induction motors but also to modified forms of this and other types of a.c. motor.

In principle this method of braking a.c. induction motors is identical with dynamic braking of d.c. motors. D.c. is passed through the stator winding, producing a stationary magnetic field in which the rotor is moving. E.m.f.'s will be induced, causing alternating currents to flow in the rotor windings. In this way the stored kinetic energy of the rotating masses is transformed into electrical energy, which in turn is transformed into heat in the rotor windings where it is dissipated.

Braking Effect and Speed of Rotation

Theoretically, the braking effect should increase with the speed of rotation, but the high currents flowing in the rotor windings at high rotor speeds react on the stator field and weaken it. Saturation also plays its part so that at high speeds the braking torque is actually reduced. With wound-rotor motors this action of the rotor currents can be partly neutralized by adding external resistance to the rotor circuit, thus reducing the circulating currents. It has been shown (T. Millar, " Dynamic Braking," *Electrical Review*, December 31st, 1943, page 887) that similar speed-torque characteristics can be obtained for braking as for motoring, the maximum torque being independent of the speed, provided the d.c. excitation is constant. The speed at which this maximum occurs, however, can be varied by the addition of external rotor resistance, thus enabling the average braking torque to be controlled. The addition of this resistance also helps to dissipate some of the braking energy outside the motor frame. It is usual to inject a direct current of two to three times the full-load phase current into the stator phase windings. Higher values would cause saturation and would therefore be ineffective.

This method of braking will not bring the motor to a dead stop, because at very low speeds the braking torque is small, but the motor speed will be substantially reduced in a very short time, depending on the rotor resistance and the magnitude of the applied d.c. No undue overloading of the stator and rotor windings will result. By variation of the injected d.c. a corresponding variation of the maximum and the average braking torque is possible to match the prevailing operating conditions.

A disadvantage of this method is the need for a d.c. supply. If only one or two motors

are to be controlled or a motor-generator-set cannot be provided, dry-metal rectifiers with transformers can be connected to the stator windings when braking is required. The ripples of the rectified d.c. are generally unimportant because the inductance of the stator winding tends to smooth them out and thus prevent the formation of parasitic fields.

D.c. injection braking is not influenced by the direction of rotation and can therefore be used with advantage for reversing starters. Furthermore, the time of application of the d.c. is not critical and some form of simple time-switch control is sufficient. It is immaterial whether the motor is single-, two- or three-phase and there are several methods of equal merit for connecting two- and three-phase stators to the d.c. supply. D.c. braking has also been successfully applied to synchronous-induction motors by short-circuiting the stator windings via a resistance and using the already existing d.c. rotating feed of the rotor for braking. The exciter supplying the rotor must, however, be separately driven in order to maintain a constant d.c. throughout the braking period. The heating of the stator and rotor windings is not so severe as with reverse current braking.

A disadvantage from which all three methods suffer is the loss of the braking torque should the supply fail. Neither of the methods described can "hold" a load and mechanical brakes have to be provided.

Electric Soil Warming

Crops and Costs

A PAPER on electric soil warming for market gardeners was read recently by Mr. W. COVER, A.M.I.E.E., A.M.I.B.A.E., F.R.H.S. (G.E.C.) at a meeting organized by the Cottingham Market Gardeners' Discussion Society in conjunction with the East Riding of Yorks War Agricultural Committee and the National Agricultural Advisory Service. Mr. Cover said that before the war soil warming cables had been constructed so that they could be connected directly to the electricity supply but these were now out of production and a low-voltage alternative was being used which comprised a transformer and a bare heating wire laid in the soil.

Reference was made to the "dosage" method of warming where the soil was not maintained at a constant temperature but was warmed by 10-15 deg F and then allowed to vary with the weather conditions. In the case of lettuces grown in frames the "dosage" was 40 watt-hours per sq ft per day in Southern England and 45 watt-hours in the North. These loadings could be obtained by using approximately 2 watts per sq ft for 24 hours per day, 5 watts per sq ft for 8 to 9 hours' warming at night only, or comparable loadings for other periods. Layout of the installation depended on the grower's requirements and therefore each inquiry had to be individually considered. Mr. Cover discussed several alternative schemes for areas ranging from a single light to ground measured in acres and gave some particulars of costs. One typical installation produced a net crop of 45 lettuces from each frame at a cost of 2d. per lettuce with electricity at 1d. per kWh. The average retail price was then 11d. each. In addition, some frames yielded an interplanted crop of 12 lb of carrots. Another installation in Brecon, S. Wales, comprised 22 ranges of frames each measuring 60 ft by 4 ft. The installed heating load was about 15 kW and since 1943 the frames had been used mainly for lettuce and carrot production. The heat was on for approximately 15 hours per day and in the spring 11,000 lettuces were produced for 1½ kWh per lettuce. Electric soil warming equipment could also be used with success in the growing of tomatoes.

Lecture at Surbiton

On January 24th a lecture on the raising of crops during winter by means of electric soil warming was given at Surbiton by MR. L. PRICE. The audience consisted mainly of local horticulturists and included the Mayor of Surbiton (Mrs. Amy Woodgate) and Dr. S. Gooding, president of the Hook and District Horticultural Society.

MR. J. D. PARKINSON, district manager of the London and Home Counties Joint Electricity Authority, opened the meeting and before introducing the lecturer referred to the seeming incongruity of sponsoring the advancement of electro-horticulture in these times of load shedding. He justified the possible increased load by explaining that the soil-heating equipment would almost invariably be used at night.

Mr. Price, who is a director of Clifford & Snell (Eng.), Ltd., and is responsible for designing and manufacturing electro-horticultural apparatus, dealt with the installation of soil-heating apparatus in garden frames and under cloches, and stressed that the mains feeding the transformer should be installed by a competent electrician to ensure safety. Referring to the space-heating equipment which was on view in addition to soil-heating apparatus, he thought that this could work in conjunction with soil heating in garden frames. He mentioned that electro-horticulture was rapidly being adopted by professional growers.

NEW BOOKS

A.C. Theory Without Mathematics. Trigonometry Questions and Answers.

Alternating Current Practice. By C. H. Claude Cooke, A.M.I.E.E., A.I.Mech.E. Pp. 232; figs. 93; index. Crosby, Lockwood & Son, Ltd., 20, Tudor Street, London, E.C.4. Price 15s.

This book is written for practical wiremen, nstallation engineers and students at technical institutes and is one more attempt to introduce these classes of readers to the practice of alternating current working without the aid of mathematics. We think, however, that the wireman and installation engineer would profit more in the long run by starting with a course in elementary mathematics without which a clear understanding of a.c. theory cannot be gained. So low does the author rate the mathematical attainment of his readers that he begins by giving brief directions for transposing simple equations, but it is only fair to say that methods of calculation are illustrated by many carefully chosen examples throughout the book, which do much to clarify the text.

The book covers the a.c. circuit, single- and three-phase; inductance and capacitance; a.c. motors and transformers; rectifying and converting plant; power factor correction and electrical measuring instruments.

Some loose statements in the first edition have been eliminated, but the author still retains the use of a few obsolete terms, such as capacity, wattless power and B.O.T. unit. There is a mistake in fig. 47, in which one phase of the motor is reversed, while fig. 59 would be better if the polarity of the machine poles were reversed, in order to identify the polarity with the direction of the current. It is surprising to find that the important subject of electromagnetism is barely touched on. The chapter on rectifying and converting plant dismisses the mercury-arc rectifier in about five pages, while the rotary convertor, now considered an obsolescent machine, is given no fewer than 14 pages. In our opinion, this space allocation might easily be reversed in order to bring this subject into line with modern practice.

The treatment, although necessarily superficial having regard to the ground covered, may be regarded as adequate for its purpose, while the diagrams are very clear and informative. The publishers are to be congratulated upon the production of the book.—H.P.Y.

Trigonometry Refresher for Technical Men. By A. Albert Klaf. Pp. 629; figs. and index. McGraw-Hill Publishing Co., Ltd., Aldwych House, London, W.C.2. Price 25s.

This is an American publication, the author being a civil engineer of the Board of Water Supply of New York City; so it is possible that some of the phrases used may have a slightly different significance from their English counterparts. The term " refresher " in the title, for example, should mean a succinct survey; but from the preface, the price and the size of the book one gets the impression that the author has tried to cater simultaneously for two rather disparate types of reader. This suspicion is borne out by the use of what he calls " the modern question-and-answer form " of presentation. In this way no statement is made, except in answer to a question, clearly set out in heavy type just before. While this evidently has advantages from the " refreshing " angle, it seems a mechanical, even rather juvenile method of learning. Elegance of presentation is impossible and one is rather left with bare facts. This, of course, may be just what the " refresher " in a hurry wants.

In this rapid, staccato fashion the book covers a wide field, from the definition of an angle up to de Moivre's theorem and spherical trigonometry with its practical applications. Indeed the general practical applications are one of the two main virtues of the book, which is written primarily for the technical man. Trigonometry is regarded as a workmanlike tool and its concrete aspects are emphasized throughout. Particularly good, in consequence, are the chapters on the slide rule, vectors, surveying and navigation; and there are numerous illustrations taken from electricity, optics and hydrostatics.

But the book's outstanding quality is the clarity of the print, the beautifully clear diagrams, the lovely smooth paper and the binding. No British publisher can possibly compete with this, even at the price of 25s. There are many pages of excellently printed tables, a summary of the main formulæ and an efficient index. The ingenious idea of providing answers to the odd-numbered problems only is one which our authors might well copy and, incidentally, earn the gratitude of the teacher in his uphill fight with the thumb in the back of the book.—F.G.G.A.M.

Broadcasting Stations of the World. Compiled by the Wireless World. Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 1s. (postage 1d.).

This booklet should prove useful to many radio listeners, particularly those who do not confine their reception to B.B.C. programmes. Details of over a thousand broadcasting stations scattered throughout the world are arranged for easy reference.

Book Received

The Story of the Telephone. By J. H. Robertson. Pp. 299; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 10s. 6d.

COMMERCE and INDUSTRY

Protest Against Electricity Bill. Underground Railway Ventilation.

THE London Chamber of Commerce has submitted a memorandum appealing to the Government "not to expose industry and commerce, at this time, to the uncertainties and hazards which the passing of the Electricity Bill would involve." The objectives set out in the Explanatory and Financial Memorandum to the Bill are said to be already in process of being realized without nationalization and "the introduction of a new and untried system must inevitably result, for the time being, in confusion, hesitation and misunderstandings." The Chamber emphasises that, beyond a certain optimum point, the increased size of an undertaking does not result in the saving of manpower. It is considered that the proposed network of Consultative Councils would be performing functions that properly belong to the Area Boards themselves. Apart from the wasteful duplication involved, the public, either as individuals or through its employers', workers', and other organizations, should have direct access with its suggestions and complaints to the Area Boards.

The proposal to give the Central Authority power to "manufacture electrical plant and electrical fittings," and to "sell, hire, or otherwise supply electrical plant and electrical fittings and to instal, repair, maintain or remove any such plant or fittings" would enable the Government to use the full weight of the State to put a large number of small concerns completely out of business.

Lord Mount Edgcumbe's House for Nation

The Earl of Mount Edgcumbe, chairman and managing director of Everett Edgcumbe & Co., Ltd., is to hand over Cotehele House, his family seat near Plymouth, to the nation in lieu of death duties, under the scheme announced by Mr. Dalton in his last Budget. The mansion, which has been in the hands of the Edgcumbe family since 1353, will, together with its contents and park, be preserved by the National Trust. The contents include a collection of late Stuart and early Georgian furniture. The fifth Earl, who died in 1944, left £600,411 (net personalty £392,154). The duty payable would be £282,188.

New Zealand Import Quotas

The *Board of Trade Journal* reports a number of amendments to the New Zealand Import Licensing Schedule for the 1947 period. One point is that consideration will be given to applications from regular importers for licences to import certain electrical wiring accessories from the United Kingdom and Australia provided that definite evidence of availability is produced. The accessories in question are 10-A flat-pin plugs and sockets; cord connectors; "tap-ons" with multiple plugs; indoor or switchboard type fuses up to 25 A; 5-A and 10-A flush and surface type switches; through cord switches; ceiling roses; and appliance plugs.

Canadian Price Control

A number of relaxations in price controls were made by the Canadian Government on January 13th. Items released from control included domestic electrically-powered washing machines, domestic stoves, ranges and other cooking or heating appliances. Control is maintained on a large number of goods including household refrigerators, sheep shearers, windchargers, electric fence controllers, building wires and cables, wiring accessories normally used in residential and farm buildings and car batteries.

Aswan Dam Tenders

It is reported by *Reuter* from Cairo that tenders for the Aswan dam hydro-electric scheme were opened on January 30th. The British Thomson-Houston Co. and the English Electric Export & Trading Co., in co-operation, submitted a tender of seven million sterling for the whole scheme, which was the lowest offer.

The Cairo correspondent of *The Times* says that among other concerns which submitted tenders were Ferranti, Ltd., Crompton Parkinson, Ltd., A. Reyrolle & Co., Ltd., and the Hackbridge Electric Construction Co., Ltd. The Westinghouse Electric International Co., New York, submitted a tender at £8 million for the delivery of material only.

Brighton Against "Closed Shop"

By 38 votes to 27 Brighton Town Council at its January meeting confirmed a recommendation of the Electricity Committee, against applying the "closed shop" principle to employees at the Southwick power station. It was stated that there was "irritation" among the manual workers because five men would not join a union.

Showroom Lighting Charge

At Newcastle-on-Tyne last week R. Rankin & Sons, garage owners, of Jesmond, were charged with the unlawful use of electric lighting fittings for advertisement purposes. N. Rankin, director, was charged with causing the fittings to be used, and R. S. Northcote, salesman, with allowing their use. The case was adjourned until February 17th.

Prosecuting for the Ministry of Fuel and

Power, Mr. R. H. C. Herron said that Rankin & Sons had applied for permission to use electricity for a showroom display of new cars at the garage, but this had been refused owing to the regulations forbidding the use of electricity for advertising. The firm later used six 12-V car batteries to light nine 36-W lights and a neon sign. Mr. J. L. R. Croft, for the defence, contended that the firm had no charge to answer as the Order related to the use of electricity from the mains only. He also asserted that the display was not for the purpose of advertisement for sale. If the case went against the defendant there would be an appeal.

Motor Manufacture in Brazil

A substantial increase in the manufacture of electric motors in Brazil was reported by the larger producers in the first half of 1946, but shortage of material was expected to affect the total for the year. According to *Foreign Commerce Weekly* (Washington), the kinds of motors manufactured in 1945 were estimated to be as follows:—

H.P. group	Single-phase Per cent	Polyphase Per cent	Total Per cent
Less than 1 H.P.	13 (*a*)	19	32
1 to less than 3 H.P.	(*b*)	43	43
3 H.P. and more..	—	25	25
	13	87	100

(*a*) The larger part of this group in 1945 consisted of very small motors not over 0·1 H.P. In 1946, production of motors up to 0·5 H.P. was expected to increase the share of this group to between 20 and 25 per cent. (*b*) Less than 0·1 per cent.

Poplar Boiler Contract

According to the *Financial Times* an order for six water-tube boilers of the biggest type made in this country, for use at the new generating station at Poplar, has been received by Clarke, Chapman & Co., engineers, of Gateshead. The order is worth nearly £3,000,000.

International Broadcasting Organization

The International Broadcasting Organization has issued the first number of its "Documentation and Information Bulletin," which also includes as an addenda a copy of the Statutes as modified by the General Assembly in Brussels on October 31st, 1946. The address of the I.B.O. is 32, Avenue Albert Lancaster, Brussels.

Simmonds Concerns Acquired

Electric and General Industrial Trusts, Ltd., has acquired the whole of the capital in Simmonds Aerocessories, Ltd., and Simmonds Products, Ltd. During the war, Simmonds Aerocessories, Ltd., operated two factories, one on the Great West Road, London, and a large Government factory on the Treforest Estate, Cardiff. During the past year, plant and personnel have been moved to the Treforest factory which is at present employing 1,170 workpeople, and it is hoped, with extensions of plant, to employ up to 1,800. Sir Oliver Simmonds has retained his interest in Simmonds Development Corporation, Ltd., with offices and a factory in the London area.

Kepier Station Compensation

Among the supplementary estimates presented last week by various Government Departments was one from the Ministry of Town and Country Planning providing, if approved by Parliament, for the payment of £6,650 ex gratia to the North-Eastern Electric Supply Co., Ltd., as compensation for expenditure incurred in making plans for the proposed power station at Kepier, Durham, which were rejected after an inquiry.

Correspondence with Japan

The Board of Trade announces that by arrangement with the Postmaster-General it has issued a General Licence (S.R. & O. 1947 No. 141) authorizing business communications of a limited character with Japan. Nothing in the Licence authorizes trade in goods or the payment or transmission of money or securities. All trade with Japan is at present on a Government to Government basis, and British traders are therefore advised to apply to the Sundry Materials Branch of the Board of Trade (10, Old Jewry, London, E.C.2) for advice on whether specific commodities are likely to form part of the import/export programme for 1947, which is now being drawn up by the Supreme Commander for the Allied Powers in Japan.

Ventilating Fan Control

One of the peculiar ventilation problems encountered by London Transport in its railway tunnels is caused by the air currents created by trains as they pass a ventilation shaft at speed. It is sometimes necessary to stop a fan and to restart it during traffic hours. Those situated at a distance from stations are controlled from a neighbouring station with an indicator to show when the motor is running.

While a fan motor is switched off, it is possible for the air currents created by trains to rotate the fan in the direction opposite to its normal; if the starting switch be then operated very large currents may flow and the overload relays will function, entailing calling out an attendant to reset the circuit before the fan can be put back into service. To overcome this, a hinged flap vane is mounted in the ventilation air passage and a contact arm fixed to it completes the control circuit through two spring contacts. When the air flow is in the normal direction the flap is pressed forward and contact is made; when the flow is reversed the flap is drawn back and the circuit is opened. A spring holds the flap in the open circuit position until the air flow

has built up to a certain pressure, to give the fan rotor time to stop before current can be switched on. When the fan motor is running, it is sufficiently powerful to overcome the complete reversal effects of the train draughts.

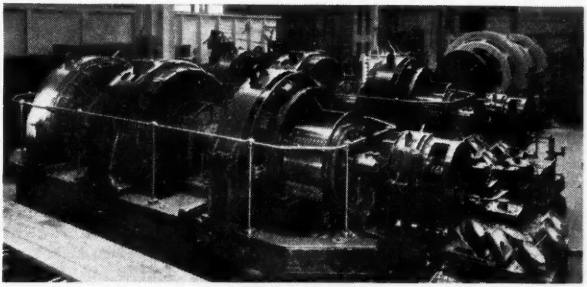
Plant for New M.G.M. Studios

For the new Metro-Goldwyn-Mayer British Studios at Boreham Wood a comprehensive electrical power plant is now being installed by Crompton Parkinson, Ltd. To provide the d.c. supply for stage lighting and power, six 500-kW motor generator sets will be available. The whole of the power system has been designed to meet the specialized requirements of sound film production.

Each motor-generator set comprises a 740-H.P., 3,300-V a.c. auto-synchronous motor driving two d.c. generators, and an exciter for the motor field. The machines are arranged in tandem, with the motor between the two generators. Each generator has an output of 250 kW (120 V, 2,083 A). Since there are two generators to a set, and six sets, the total current output is nearly 25,000A.

A special feature of the d.c. generators is that they have been specially designed to give a current output with the minimum of ripple. In most studios costly and cumbersome portable chokes are required to smooth out the ripple, but with these specially designed generators portable chokes are avoided, the only additional smoothing equipment installed being a system of laminated chokes and condensers connected to the outgoing d.c. feeders in the power station. To ensure the minimum of noise and vibration in the vicinity of the studios, the machines are mounted on substantial foundations and bedplates, and were designed to operate quietly by reducing magnetic hum and windage noise to low levels.

The three outdoor 11/3·3-kV, 1,600-kVA transformers supplying the autosynchronous motors are also designed and mounted to reduce the levels of noise and vibration. The transformers were manufactured by the British Electric Transformer Co., Ltd. (in association with Crompton Parkinson, Ltd.).



Two of six 500-kW motor generators which are now being installed at the M.G.M. Boreham Wood studios on test at the Chelmsford works of Crompton Parkinson, Ltd.

Batti-Wallahs' Luncheon

Mr. Hugh Quigley, M.A., was the principal guest and speaker at the monthly luncheon of the Batti-Wallahs' Society on January 30th. He was introduced by the president, Mr. P. V. Hunter, C.B.E., and his subject was "Industrial Reconstruction in 1947." Mr. Quigley surveyed present conditions in this country and was critical of the Government's methods of coping with them. He said that at the moment the Government was endeavouring to export more than was good for the country's well-being to pay for imports—many of which were not essential. To do this it was prepared to restrict agriculture and it had also restricted coal production. Nationalization would also result in the restriction of electricity for a number of years until the personnel and higher administrative officers had been trained for their work.

The sellers' market in America was coming to an end, and for us it would not last longer than another eighteen months. After that the Government would have to change its policy for one of greater development of our internal resources. A vote of thanks to the speaker was proposed by Col. H. J. Wellingham. Mr. Mark Whitgift, the hon. secretary, announced that the speaker at the next luncheon, to be held on February 27th, would be Sir Hartley Shawcross, the Attorney-General.

Electricity Workers' Holidays

The Guisborough (Yorks) Urban District Council has decided not to adopt the recommendation of the Joint Industrial Council for a fourteen days' annual holiday for electricity workers.

London Domestic Science School

The London School of Electrical Domestic Science, of which Miss H. M. M. Minoprio has been principal and a director for many years, recently came into the market and, in order to ensure that the School should continue to give instruction exclusively in electrical domestic subjects, it has been purchased by the Jackson Electric Stove Co., Ltd. It will be the policy of the company to continue to preserve a completely neutral attitude regarding instruction in the use of all manufacturers'

appliances. Although Miss Minoprio is resigning her position as principal she will continue as a director and her knowledge and experience will prove of great value. Messrs. S. C. Hurry and W. S. Foster of the Jackson Electric Stove Co., Ltd., have also been appointed directors. Mrs. V. Bain, who has been the senior instructor since the reopening after the war, will be principal. The School will continue to train students for the electrical industry, as has always been its object.

American Public Power Expenditure

In his annual budget message to Congress, the President of the United States asked for increased appropriations for public flood control, irrigation and power undertakings in respect of the fiscal year 1948. Among the amounts was one of $250 million for the Rural Electrification Administration as a lending fund. The Bonneville Power Administration calls for $20·3 million mainly for new substations and transmission lines. An appropriation of $27 million for the Tennessee Valley Authority is additional to expenditure from revenue amounting to $33 million. President Truman said that $444 million would be expended during the coming year upon atomic energy research.

Liquidators' Explanation

In the *London Gazette* of January 24th notification was published of the final meeting of Tormo, Ltd. (in voluntary liquidation). The liquidator of the company explains that the notice relates to the old company which was wound up upon a capital re-arrangement in 1941 when the business was transferred to the present company bearing the same name. The latter company has since carried on the business and continues to do so.

International Management Congress

The eighth International Management Congress is to be held in Stockholm from July 3rd to 8th, under the auspices of the International Committee of Scientific Management. Arrangements for British participation in the Congress are in the hands of the British Management Council. The Congress will provide the first post-war opportunity for many people in this country to secure a swift appraisal of the principal trends and developments in management practice abroad since 1939. The emphasis in the Congress programme is essentially on the human and social, rather than on the material, aspects of management, and the three plenary sessions will be devoted to the philosophy and application of scientific management, regional and local planning in modern society, and industrial relations and the responsibilities of management and labour.

There will also be fourteen sectional meetings devoted to the various aspects of management. A comprehensive programme of works visits and general interest tours will take place at the conclusion of the Congress. It is expected that between 150 and 200 people will attend the Congress from Great Britain, including representatives of Government, industry and commerce, as well as of the many societies concerned with the advancement of management. Inquiries with regard to British participation in the Congress should be addressed to the Secretary, British Management Council, 15, George Street, London, E.C.4 (Phone: Mansion House 5511).

Trade Publications

English Electric Co., Ltd., Queen's House, Kingsway, London, W.C.2.—Illustrated brochure (DM/129) on colliery drip-proof motors.

Watson & Sons (Electro-Medical), Ltd., Sunic House, Parker Street, Kingsway, London, W.C.2.—Illustrated brochure No. 560 describing the Pullin 100-W optical projector for viewing mass miniature radiography films on a screen at 30 in. distance. Also No. 403 on the ST.150 X-ray therapy apparatus of shockproof design for tubes needing up to 15 mA at 150 kV peak.

Elcordia, Ltd., 225, Westminster Bridge Road, London, S.E.1.—Descriptive leaflet on heavy and light soldering irons.

W. Jessop & Sons, Ltd., Brightside Works, Sheffield.—Technical brochure on the properties of steels and high-performance alloys for magnets.

Electric Art Shades (1928), Ltd., Ferring Factory, Kelvedon, Essex.—Coloured folder (No. 120) illustrating shades for table and pendant lamps.

Dawe Instruments, Ltd., Harlequin Avenue, Great West Road, Brentford, Middlesex.—Illustrated leaflets on a decade inductometer and ratio arm box.

Ardente Acoustic Laboratories, Ltd., Compton, Guildford, Surrey.—Illustrated brochure and separate price list of marine sound equipment, ship's internal communicator and broadcasting systems, external loud hailers and the "Diverphone" for use under water.

Liverpool Electric Cable Co., Ltd., 24, Queen Anne's Gate, Westminster, London, S.W.1.—Illustrated brochure describing "Lecupler" bolted flameproof cable couplers.

William Jessop & Sons, Ltd., Brightside Works, Sheffield, 1.—Illustrated brochure on cemented carbide "Duritas" drawing dies of all kinds.

F.B.I. Northern Regional Council

A Northern Regional Council has been set up by the Federation of British Industries under the chairmanship of Mr. Clive Cookson.

Trade Announcement

Guy Morrison & Co., Ltd., 23, Upper Grosvenor Street, London, W.1 (telephone: Mayfair 0907) have been appointed sole overseas distributing agents for "Buk" electric shavers.

In Southern Rhodesia

Electrical Achievements and Possibilities

By Douglas Spencer

IT must be some sixteen years ago that I last sent news of the position of electricity in Southern Rhodesia. At that time my remarks had to be confined to possibilities, they can now describe actual realities and real development, and its results.

In the intervening period the white population has increased by about 200 per cent and trade has increased in proportion. Last year, too, i.e., 1946, sales of tobacco leaf reached the figure of £5,500,000 and this year (1947) it should reach a higher figure.

The outstanding feature in electrical development during the last twelve years has been the birth of the Electricity Supply Commission, established as a Government controlled and managed body in 1936. The expansion of the Commission's activities can be gathered from the fact that the sales of electricity rose from 142,210 kWh in 1935–36 to 129·5 million kWh in 1945–46. Of the latter total 102·1 million was used in mining, 13·1 million in municipal areas, 2·9 million in rural districts and 11·4 million by industry other than mining.

The amount of capital expended up to March 31st, 1946, stood at £2,713,599, and the installed capacity at all generating stations totalled 36,855 kW and an addition of 20,000 kW of plant for the central power station at Umniati was ordered during the year.

Nucleus of Grid System

The heart of the grid system is on the Umniati river some 15 miles from Que Que. The nucleus of the system was in Gatooma, with 2,000 kW installed. It was in Gatooma that the scheme of the E.S.C. was really originated, on a report by the late Mr. Metelerkamp, the electrical engineer for Salisbury, but owing to shortage of water in Gatooma the site for the main power station, as now being developed, was fixed on the Umniati at a point about 25 miles from Gatooma.

As will be seen from the statement of energy sales above, the basic market for power is on the mines, and it will be of interest, in view of possible markets for electrical gear, to note the accompanying table of sales of electricity to mines in the neighbourhood of various points of supply.

Power for Bulawayo and Mazoe is brought from Bulawayo and Salisbury city stations. The E.S.C.'s biggest industrial market is round Bulawayo (8,533,850 kWh).

It is really owing to the wide distribution of the mines that it has been possible to extend rural lines, and out of 650 consumers connected 231 are on farms, each using an average maximum of say 25 kW on grinding food for natives and cattle, pumping and domestic uses such as lighting, cooking, heating, refrigeration and vacuum cleaners and irons.

Supply Point	*kW installed*	*Mining sales kWh*
Bulawayo	—	8,943,863
Gwanda	7,500	19,228,064
Gwelo	4,500	10,553,126
Umniati (Central)	10,750	28,407,738
Umtali	6,500	9,294,333
Mazoe	—	5,386,893
Shabani	7,500	20,353,869
Total ..		102,167,886

In my own case the basic charge per month for the farm is £3 and 1d. per unit consumed, and my distance from the central power station is well over 60 miles. My electrical equipment is much like that on other farms. It comprises a 15-H.P. and a 2-H.P. Crompton motors, a G.E.C. vacuum cleaner, an Electrolux refrigerator (American), an electric kettle, a two-plate stove (Canadian) and three electric irons. A "complete" firm should in the normal way be able to obtain a good deal of work with an outdoor salesman and installation staff.

Development Prospects

As to the future increases in the outlets for electricity, it is more than possible that it will be used with automatic cut-outs for the curing of tobacco. This commodity can afford a good price for current and the opportunity should certainly be studied—it can probably stand a higher charge than tea. Any firm specializing in heating of this nature should certainly examine the matter closely, and earn the gratitude of many old (and young) tobacco growers who prefer a good night's rest to watching a thermometer in their tobacco barns.

Electro-metallurgy and electro-chemistry will also play a very important part, in view of the many varied types of minerals obtained in Southern Rhodesia and exported. Water power will no doubt help to reduce costs of power when the conservation of water has proceeded further, and more dams are constructed for the dual or triple purpose of alleviating soil erosion troubles, the irrigation of wonderfully fertile soil which can produce crops all the year round, and provide electric power constantly.

There must be now in England thousands of ex-R.A.F. men who thoroughly know their way about Southern Rhodesia—a wonderful supply of men to introduce goods from the homeland to the speedily increasing population and the expanding range of industries, such as iron and steel in Que Que, and textile works growing up near Gatooma, with plant from Lancashire.

It is a strange country. On one side of the road you will see a couple of tractors working; on the other three or four ox-drawn ploughs turning the red soil and endangering the power lines. It waits for electrically driven agricultural machinery.

There is a possibility of a group forming a Water Power Association, and as it is the farmers who are naturally most interested in the development of hydro-electric power combined with irrigation, it might be well for engineering firms interested to send catalogues and descriptions of plants installed to the Farmers' Co-operative Society in Salisbury.

German Industry

B.I.O.S. Exhibition to Tour Regional Centres

THE British Intelligence Objectives Sub-Committee Exhibition, which was held at the Board of Trade, Millbank, in December, is now on tour of the principal regional centres. The following dates and places have been arranged for the provincial tour of this Exhibition:—Nottingham (the Guildhall, February 3rd to 7th); Cardiff (University College, Cathays Park, February 17th to 21st); Glasgow (Kelvin Hall, March 3rd to 7th); Newcastle (Chronicle Hall, Westgate Road, March 17th to 21st); Sheffield (City Hall, March 31st to April 4th); Manchester (place not yet fixed, April 14th to 18th); Belfast (Technical College May 5th to 9th).

Many firms have not the necessary staff available to examine the whole range of reports relating to their particular industries and the B.I.O.S. Information Section, 37, Bryanston Square, London, W.1, was set up some months ago to perform this service on behalf of industry. In addition to dealing with inquiries arising out of reports published by the Stationery Office, the Section has access to a considerable number of site reports on German factories and research establishments, original German documents, and miscellaneous items of information which, by their nature, are not suitable for reproduction and publication by the Stationery Office. All inquiries about German technical processes covered in B.I.O.S., C.I.O.S., F.I.A.T. and J.I.C.A. reports, as well as requests for information which may otherwise be available in the United Kingdom, should be directed to the B.I.O.S. Information Section.

With reference to the B.I.O.S. Reports and the Exhibition, the Board of Trade points out that, although no invention made in Germany during the period between September 3rd, 1938, and December 31st, 1945, can become the subject of a valid British patent, nevertheless some of the information gathered in Germany may be covered by valid patents or patent applications in the United Kingdom. In order to avoid infringing patent rights, therefore, firms interested in exploiting any particular item are advised to investigate the patents position in the United Kingdom before going into production. Similar investigations are also desirable before exports are made to any particular country abroad.

Recently Published Reports

Latest reports on Germany industry prepared by British and Allied investigating teams include the following:—B.I.O.S.33. "The German Electric Lamp Industry" (2s.). B.I.O.S. 410. "Some Electrical Factories in Berlin—British Zone" (3s. 6d.). F.I.A.T. 286. "Coaxial Cable & Associated Telephone & Television Systems" (3s. 6d.). F.I.A.T. 705. "High Frequency Magnetophon Magnetic Sound Recorders" (4s.). J.I.O.A. 54. "German Developments in Semi-Conducting Materials" (8s. 6d.). F.I.A.T. 831. "Sodium Sulphate Electrolysis with a Mercury Cathode" (2s. 6d.). F.I.A.T. 502. "Heavy Electrical Machinery Manufacture in Germany" (1s.). F.I.A.T. 822. "Electrolytic Mercury Oxide at Burghausen" (6d.). A few copies are available at the Stationery Office at the prices quoted, postage extra.

Cheaper Electricity for Quebec.—From April 1st, 1947, the Quebec Hydro-Electric Commission is to reduce commercial and industrial electricity tariffs by 10 per cent, and the Provincial Electricity Board is studying the possibility of a substantial general reduction in electricity tariffs in the province.

Better Welding Transformers

Micanite Tape Separators

By H. K. Whitehorn, B.Sc. (Lond.)

THE principal cause of transformer breakdowns is the failure of insulation between two adjacent turns, thereby short-circuiting a portion of the winding which will lead to the burning out of the transformer if the fault is not detected in time. For the last eleven years the transformers supplied by A. I. Electric Welding Machines, Ltd., have all been constructed with an additional separator of micanite tape (Fig. 1) between every turn.

Since the thickness of the tape is only 0·006 in., it does not take up much room and can nearly always be added to an existing specification. When there are very many turns the inclusion of the tape affects the space factor and so must be allowed for. The tape is manufactured by Micanite & Insulators, Ltd., and consists of two overlap layers of mica splittings (Fig. 2) with paper on both sides. It is fed continuously into the coil being wound as a single flat separator between adjacent turns (Fig. 3) which represents: A, multiple drums (braked) on stand; B, strips of copper; C, guide; D, slide clip; E, roll of ordinary red stripe tape held in the operator's hand; F, micanite-paper tape from free peg on frame of machine guided as main winding is "inched" round by foot switch; G, power driven winding machine.

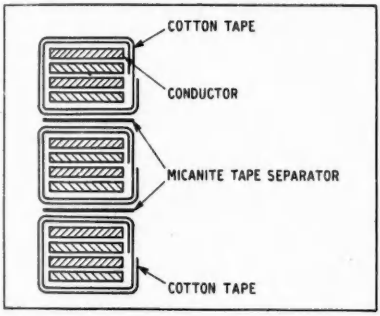


Fig. 1.—Transformer coils showing positions of micanite tape between adjacent turns

Although the voltage drop per turn is very low, the breakdown stress which the micanite tape alone would stand when submitted to test would be several thousand volts, but the essential feature of the tape is its indestructibility by fire or overheating. The micanite will not burn; it is admitted that the paper on the top and bottom of the tape will burn, but it will stand up to the same temperature as the varnish and other insulation covering the turn of the winding.

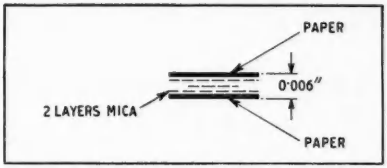


Fig. 2.—Enlarged representation of tape make-up

Now as regards the width of the micanite tape: it is usually planned to a dimension $\frac{1}{16}$ or $\frac{1}{8}$ in. wider than the copper section of the transformer turn. When the copper section is a bare strip, then the micanite tape must be rather wider, say $\frac{1}{4}$ in., which means $\frac{1}{8}$ in. overhang at each end with bare strip of say $1\frac{1}{2}$ by $\frac{1}{16}$ in. h.c. copper having rounded edges. For a large coil using the section just mentioned it is advisable to employ very

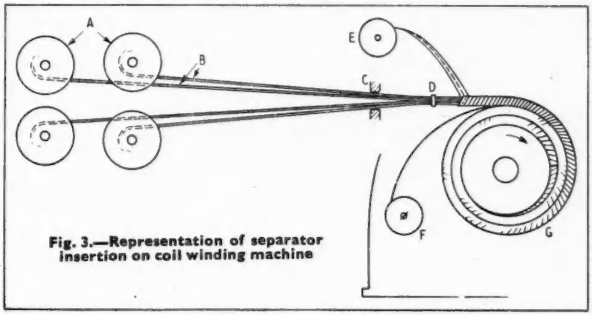


Fig. 3.—Representation of separator insertion on coil winding machine

thin cotton tape wound in the ordinary way on alternate turns, in order to avoid the risk of mechanical shifting or slipping sideways between the period of winding on the winding machine and covering with tape ready for vacuum impregnation, as there is a better coefficient of friction between the cotton tape and the paper part of the micanite tape. If there is sufficient space to spare, it would be helpful to use the thin cotton tape throughout the winding and then the micanite tape separator would form an extra safeguard against the possibility of breakdown due to overheating.

The overheating risk is not so much that which is provided for by the temperature rise limits given in B.S. specifications and similar statements of performance, as the occasional extraordinary load on the transformer by an operator who does not understand that excessive performance on the part of his machine may burn out the transformer.

The cost of the addition of the micanite tape should be compared with the cost of the whole machine of which the transformer is only the electrical power part. The cost is insignificant when it is balanced against the enormous cost, inconvenience, and loss of business, which can arise from a breakdown. Therefore the use of such a micanite tape separator is very highly recommended.

Shipwrights' Exhibition

APART from the many builders of boats, there are seventy firms in the British Isles building steel ships. Their progressiveness in design was reflected in the numerous scale models of all types of mercantile and war ships at the Worshipful Company of Shipwrights' exhibition (January 28th to February 8th) in the Royal Horticultural Society's two halls in London.

In connection therewith valuable prizes and other awards for model making were offered, in addition to the annual prizes to shipwright apprentices and students. Fifteen cinema films were shown and 47 papers read, Mr. W. K. G. Allen dealing with marine auxiliary Diesel generators, Mr. F. P. Best with radar and radio on board ship, Mr. J. D. Eskdale with ships' auxiliaries, Mr. M. Riley with welded *versus* riveted ships and Mr. R. J. Welsh with Diesel-electric propulsion.

Among the 163 exhibitors Minimax, Ltd., had a newly designed caterer's set for making coffee and other hot beverages, which is electrically heated by multiple elements and controlled by thermostats in conjunction with magnetic valves.

Thomas Bishop, Ltd., showed a cooking-range constructed of mild steel with a stainless steel top, two ovens, twelve boiling plates, a griller-toaster and three-heat control by ten rotary switches covered with stainless steel.

Cable & Wireless, Ltd., was represented while the Marconi International Marine Communication Co., Ltd., displayed radio telegraphy and telephony apparatus, direction finders, auto-alarms, sound reproducing devices, depth sounders and radar equipment. The International Marine Radio Co., Ltd., had a ship's complete installation and subsidiary navigational aids.

Londex, Ltd., demonstrated a navigation buoy containing a special filament lamp in a lens and energized by special accumulators (unattended from six months to two years between recharges) incorporating a newly designed night-day switch based on the photo-electric principle and combined with a flasher. The latter can be controlled from a distance, without cables or radio impulsing, by the passage of current through sea water mainly for sea-drome flarepath lighting.

Ships' auxiliary machinery displayed by W. H. Allen, Sons & Co., Ltd., included a back-pressure steam turbine geared to a compound d.c. generator of 80 kW at 220 V; also a single-cylinder steam engine directly coupled to a d.c. generator of 10 kW at 110 V, motor driven pump as well as hand and automatic starters.

In addition to the Cable Makers' Association there were samples of the products of British Insulated Callender's Cables, Ltd., and arc welding displays by the English Electric Co., Ltd., Murex Welding Processes, Ltd., Quasi-Arc Co., Ltd., and various qualities of welding wire by the United Steel Companies, Ltd.

Also represented were Chadburns (Liverpool), Ltd., electric engine room telegraphs; Henry Browne & Son, Ltd., electric log, fathometer echo sounder, loud hailer; S. G. Brown, Ltd., gyro compass, automatic helmsman with bearing repeaters, course and rudder angle recorder; Sperry Gyroscope Co., Ltd., two-unit self-synchronous gyro pilot and automatic electric steering control; Stevenson & Struthers, Ltd., automatic electric control for fog whistle; Stream-Line Filters, Ltd., for lubricants and oily water separation; Clark Chapman & Co., Ltd., winches and floodlights for cargo handling; Siebe Gorman & Co., Ltd., divers' underwater telephone, submarine electric lamps, underwater cutting and welding appliances; Tufnol, Ltd., deck insulators and other electrical parts; Thermotank, Ltd., heating and ventilating fans; E.C.D., Ltd., air-freshening "Ozóno" generators.

ELECTRICITY SUPPLY

Brighton Inquiry by Candle-light. Power Station Loan Charges.

Bermondsey.—STREET LIGHTING CONTROL.—At present the street lamps are switched on and off by hand. The Electricity Committee is of the opinion that the time-switch method is the best for local requirements and proposes to arrange for a trial installation.

Brighton.—SOUTHWICK EXTENSION INQUIRY.—A joint inquiry by the Electricity Commissioners and the Ministry of Town and Country Planning was held at Brighton on January 30th into an application by the Brighton Corporation for permission to extend the Southwick power station. In the course of the proceedings there was an electricity cut and the inquiry was continued by the light of candles. The extension scheme is estimated to cost £14,000,000.

Darlington.—LOAN APPLICATION.—The Town Council has applied to the Electricity Commissioners for sanction to borrow £47,906 for the laying of h.v. feeder cables from Salutation Corner to the waterworks and from the generating station to Springfield, Neasham Road and Yarm Road.

Exeter.—HIRE SCHEME.—The Electricity Committee has withdrawn the hire-purchase scheme for electric cookers and introduced a plain hire system for an experimental period of one year.

Finchley.—LOANS.—The Electricity Committee is seeking sanction to borrow £10,000 for mains and services, £5,000 for meters and £7,000 for transformers.

DOMESTIC APPARATUS WIRING.—A panel of contractors has been formed for wiring work in connection with the hire schemes.

CHANGE-OVER.—Sanction has been obtained for the change-over to a.c. throughout the area.

Hammersmith.—ASSISTED WIRING.—A revised scale of charges for the purchase, hire-purchase or hire of new wiring installations under the Council's assisted wiring scheme is to be put into operation from April 1st next in view of higher costs. For installations which have been in service for fifteen years reduced rentals and charges are to apply.

Hull.—CORRECTION.—Mr. W. Morris, the city engineer and surveyor, informs us that the report in our issue of January 10th that sodium vapour street lighting is to be installed is inaccurate and refers to another town. We regret any inconvenience that may have been caused.

Ipswich.—EXTENSION SCHEMES.—Proposals in connection with the provision of electricity supplies to the Maidenhall estate involve an estimated expenditure of £45,163, and application has been made for the necessary loan sanction. An additional 500-kW supply is to be given to R. & W. Paul, Ltd., at Eagle Mills, at a cost of £2,522. To improve the supply in the Suffolk Road area a new substation is to be constructed at an estimated cost of £20,878. It had been originally proposed to make temporary use of the works substation of Gabriel, Wade & English, but agreement was not reached with the company.

London.—TRANSMISSION CABLE.—It was reported to the London and Home Counties J.E.A. this week that the London Power Co., Ltd., was applying to the Electricity Commissioners for consent to the laying of a 22-kV transmission cable, with pilot, control and telephone cables, between Brompton, Alpha Place and Amberley Road distributing stations, the total estimated cost being £329,000.

REORGANIZATION.—When Mr. N. R. Elliott was appointed general manager and chief engineer of the J.E.A. last year he was instructed to report on the organization and functions of the various departments. The Finance Committee has expressed its appreciation of the excellent report which the general manager has now presented and proposes to submit recommendations giving effect to the proposals contained in the report.

Manchester.—CONSTRUCTION OF CARRINGTON STATION.—Application is to be made to the Electricity Commissioners for sanction to borrow £6,742,900 for constructing the first section of the new Carrington generating station. The initial installation will comprise two 60-MW turbo-generating and condensing plants, four 360,000 lb per hr boilers designed to burn pulverized fuel, electrostatic filters to cleanse the flue gases before discharge from a 300-ft chimney, transformers to step up the supply to 132 kV for transmission, and a circulating-water system to use water from the Manchester Ship Canal for condensing purposes.

The Finance Committee says it is probable that authority will be given for the suspension of the sinking-fund provision during the construction period, and that this will last until after nationalization. Therefore the charge falling on the revenue of the Electricity Department would be in respect of interest only, until the undertaking passed into Government ownership.

Middlesbrough.—ELECTRICITY EXTENSIONS.—The Town Council intends spending £19,000 for mains and substation extensions, £7,765 for meters and meter testing equipment, £1,820 for new vehicles for the Electricity Department, and £6,550 for hire-purchase apparatus.

Poplar.—FINANCING POWER STATION CONSTRUCTION.—The Electricity Committee has obtained sanction to borrow £4,243,000 for the new power station.

INDUSTRIAL SUPPLY.—At a cost of £2,304 the Electricity Committee is to provide an

e.h.v. supply to Millwall Ingot Metals, Ltd., at Empire wharf, West Ferry Road.

Rugby.—STREET LIGHTING.—Conversion of street lighting to electricity will cost £30,000.

Shipley.—NEW FEEDER.—An additional h.v. feeder is to be installed from Clarence Road substation to Nab Wood substation at a cost of £3,963.

Stoke Newington.—INCREASED BULK SUPPLY.—In connection with the provision of an increased bulk supply from Hackney to meet the growing demands in the area, it is proposed to purchase from the C.E.B. three 10,000-kW "pool" transformers and lay an additional cable. This plant would provide for a maximum demand of 20,000 kW, the estimated cost being £17,458.

SERVING NEW HOUSES.—At a cost of £1,681, the Electricity Committee is to provide a supply to the Woodberry Down housing estate.

Todmorden.—SUPPLIES IN OUTER AREAS.—The Electricity Committee has asked the electrical engineer and manager to prepare estimates for the provision of extended services to outlying districts.

York.—REFRIGERATORS FOR ALL COUNCIL HOUSES.—The Housing Committee is to install electrically operated refrigerators in all future Council houses, the weekly hire figure being included in the rentals.

REWIRING OF SANATORIUM.—The Fairfield Sanatorium is to be rewired and the electrical equipment renewed at a cost of £1,020.

Overseas

India.—MADRAS.—A *Reuter* message from Madras states that the Madras Government on January 28th decided to take over ownership of the Madras Electric Supply Corporation, at present owned by a British joint stock company, in August this year when the licence granted to the British company expires. The purchase price and other details are to be settled later.

Supply Workers' Wages

Details of New Agreement

LAST week we announced that a national agreement had been arrived at by the National Joint Industrial Council for the Electricity Supply Industry. We have now received a copy of the agreement from Mr. A. H. Banks, the employers' industrial adviser. It is not possible to reproduce this agreement fully, but note may be made of some leading points.

As stated in our last issue, the agreement does not apply to the Greater London District. Undertakings are placed in one of two zones ("A" and "B") and there is a "differential" of ¾d. per hour in the rates of the two zones. There are 75 grades for each of which a rate is fixed, ranging from 24·00d. per hour for labourers to 32·00d. for installation inspectors. The rates for substation and switchboard attendants are graded according to the size of their stations.

Day workers' hours are forty-seven per week. Overtime between normal stopping time and midnight or from 6 a.m. to normal starting time is paid for at the rate of time and a half; from midnight to normal starting time the rate is double. An employee who leaves work after midnight is paid single time between leaving work and the normal starting time on that day. Time and overtime worked on Sundays and public holidays carries payment at double rates. Day workers required to work at night for not less than three consecutive nights are paid at time and a third.

Shift workers work a normal shift of eight hours and an average of 48 hours a week. The usual addition to their wages is 1½d. per hour, but if they work on Sundays the addition is 3d. Overtime for the first four hours is at time and a half; thereafter double rate is paid, calculated on the bare rate. Work on the normal day off carries double rate.

Charge hands (defined in the agreement) are paid not less than 2d. an hour more than the schedule "A" rate of the men under their charge. Foremen's rates are to be mutually agreed between undertakings and the appropriate trade unions, but they are to be not less than 4d. an hour higher than the schedule "A" rates of the highest-paid employees (other than charge hands) under their control.

Existing rates which are higher than the schedule rates are to be continued, although in the case of a general reduction in schedule rates they may be reduced by the same amount. Percentages are fixed for apprentices and juniors and "equal pay for equal work" is stipulated for female employees.

Switchboard and substation attendants and their assistants are to be paid the schedule rates except where they have a supervisory status and are engaged in supervising duties; are responsible for the control of load distribution; control manually-operated sub-stations other than those in which they are actually engaged; or are engaged on switchboards or in substations for a temporary period of their training as technical engineers. These exceptions come within the scope of the National Joint Board agreements.

The agreements relating to sick pay and holidays are incorporated in and form part of the new national agreement.

Attached to the agreement are schedules giving day rates for all grades; definitions of duties of certain grades; and constituent undertakings showing their districts and zones. There is also an index.

Technical Colleges Need Help

Staff, Laboratory Space and Equipment

By J. F. Yates, M.Sc., M.I.E.E.

These notes have been written with the object of drawing the attention of industry, and electrical industry in particular, to the present difficulties and those of the immediate future, which confront technical colleges

IT is well known that there is a tremendous growth in the number of students in attendance at technical colleges. The Government has done what it considers necessary to encourage the growth of technical education. The professional institutions have been considering the subject for some years and have issued various reports. The teachers themselves have tried to help in many ways which are not always known to the public. The result is that many more apprentices are becoming "college conscious," and a big interest is being shown by ex-servicemen. Some of the latter may be resuming courses they had started before entering the Services, but there are many others who have had their technical potentialities stirred by Service courses of one kind or another and who had no previous interest in technical matters. On the other side of the picture, many more employers realize that there are definite immediate as well as future advantages to themselves as well as the apprentices if they grant part-time day release. The old "diehard" type of employer is becoming comparatively rare, although he does still exist and nothing short of compulsion will alter his narrow and selfish behaviour.

These are the factors which have produced the avalanche of students which threatens to overwhelm colleges all over the country. Many colleges were working more or less to capacity in their evening courses before the late war, but now they have a four- or five-fold increase in their day load—more in some sections. They are often now working to capacity in the day as well as in the evening and this is a new situation—except for possibly during the war, when Service personnel filled a large part of many colleges in the daytime.

This new situation has created some disturbing problems. One is that the full-time technical teacher has to be almost entirely employed in the day work, because part-time day teachers are difficult to obtain, although a small amount of assistance has been given by industry—by the loan of suitable men for one or two half-days per week. More and more, therefore, the evening classes are being handed over entirely to part-time evening teachers, and while many of these teachers are very capable, they are not quite so satisfactory as when they have a leaven of full-time teachers, who can co-ordinate the evening with the day work, who have a more detailed knowledge of the laboratories and equipment, and who naturally feel more responsibility for the care and maintenance of equipment.

It has already become evident that the multiplication of classes for each stage of a course, plus the absence of full-time teachers, is occasionally producing very disappointing results. There may be additional factors but it is certain that these factors are important. Many full-time teachers and others have hoped and worked for this swing-over to part-time day work but the present conditions are embarrassing. It is debatable how much attention should now be given to the encouragement of evening classes in view of the greater benefit conferred on everybody by part-time day classes. The general hope is that, except for recreational and cultural purposes, evening classes will almost completely disappear, but until every student under eighteen years has the opportunity for part-time day training, the evening student merits the best possible treatment by the colleges.

The next problem is laboratory space and equipment. Most colleges can find some kind of space for lectures either inside or outside the parent buildings, but when they have filled such space the laboratories are usually hopelessly inadequate. In addition the existing machinery or apparatus may be very old and has probably been worked very hard during the war, and is still doing a full-time job from 9 a.m. on Monday morning until noon on Saturday, including every evening. It probably gets insufficient attention and maintenance because of this continual use. This is the real bottleneck and the main object of this article is to see whether anything can be done to help, and

to appeal for outside help *now*. Accompanying this bottleneck is the question of finance. Most principals would spend the necessary money on new buildings—if and when the opportunity offered—and also on the replacement and extension of equipment, but these principals in most cases have not the funds available for any serious expenditure in this direction.

The onus of development has been placed by the Government on the shoulders of local authorities and while the Government will provide its share of the new expenditure on approved schemes, it still leaves a large amount to be found from local rates. Consequently, when a principal has to ask his committee or governors for a substantial sum of money for expansion, in addition to an ordinary expenditure well above pre-war figures for salaries, maintenance and replacement, there is often a cool reception and perhaps a downright refusal. Naturally the local rates must be kept reasonable, especially in pre-war "depressed" areas, which often contain good technical colleges, and where the rates may already be not less than 20s. in the pound. The fact remains, however, that pre-war allowances for such purposes, even when increased by perhaps 50 per cent, are far too small in view of the increase of prices and the large increase in the number of students.

Pressure on Advanced Courses

In many cases, next year's entrants to the advanced courses such as the Higher National Certificate and to a smaller extent the B.Sc. degree courses, are going to show another big jump in numbers. This is because of the large increase during the past two years in the numbers of holders of the Ordinary National Certificate and the Intermediate B.Sc. As all colleges do not cater for advanced work, the problem will consequently be especially acute for those which do cater for it, and present hopes of accommodating all qualified students in advanced stages are small.

The main remedies are simply more teaching staff, laboratory space and equipment. The alternative course of dropping the earlier stages of the courses, such as the S1 and perhaps the S2 stages of the Ordinary National Certificate, is fraught with several difficulties, such as the capacity of the other colleges to which they would be transferred and the financial demand for the payment of such transfer on the transferring authority.

The question of new staff will not be so difficult as that of laboratory space and equipment. Some colleges are well-known—perhaps because of their situation—and are already handsomely endowed by industry, but the greater number, including many whose work is of the highest order and recognized as such, are struggling for lack of financial assistance and space. Until the Government can fully nationalize technical education, the outlook for these colleges is dim, and only immediate and generous help from industry can, in my opinion, allow them to cope properly with the immediate future. Fees received from students offset only a small fraction of the cost of a college, but a large part of this revenue will disappear in the comparatively near future, when they are abolished for apprentices under eighteen.

Assistance from Industry

There are engineering advisory committees for some colleges, with industrial, trade union, and educational representatives, and I suggest that when they have made themselves fully conversant with the needs and aims of their particular college, their first duty is to ask industry, and in particular big industry, to give generously of equipment and to replace it when obsolete. In addition, industry should create funds to purchase equipment not available locally and to help with extensions when these become possible. Only in this way will some colleges be able to meet their commitments in the next few years and defeat the attempt of a minority (which thinks that expansion should not take place) to fix a "ceiling" for capacity. Is it too much to hope that industry will meet the colleges at least half way and make contact with principals and heads of departments?

Air Cooling of Power Plant

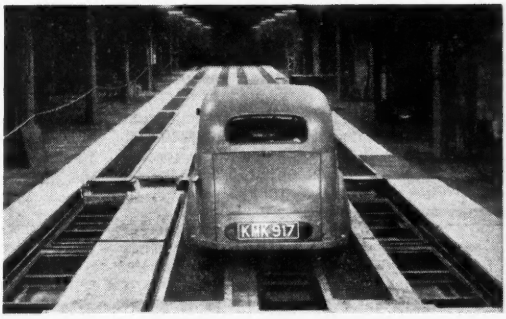
THE use of air instead of water for cooling the steam condensers associated with turbo-generators of electricity is advocated in "Strojnicky Obzor" (Czechoslovakia) by J. Flieder who holds Czech patent P.1567. The author bases his claims on economy and reliability, proposing the combination of finned coolers with screw type fans. He claims that less space would be needed than for condensers associated with water-cooling towers, less make-up water to replenish loss by evaporation, less power to drive fans than pumps, while independence of the availability of large sources of water would increase the safeguard against stoppage.

Mechanized Car Park

Minister of Town and Country Planning Attends Demonstration

THE Baldwin-Auger Mechanized Car Park, manufactured by the Fraser & Chalmers Engineering Works of the General Electric Co., Ltd., was demonstrated recently to Mr. L. Silkin, the Minister of Town and Country Planning, police chiefs, and the heads of service and planning departments.

The main principles of the car park are that a length of sectioned track carrying up to nine cars moves forward the length of one car section. The end section, the tenth, is thereby left without track, and the track resting on the end section of the adjacent row traverses across to fill this space. It is the adjacent row which now has the one section without track, and that row, accordingly, moves forward to fill it. Continuation of the sequence effects a circulatory movement around a pair of parallel tracks, and enables the car on any particular section to be transferred rapidly to the end position used for drive-off.



Track of the mechanized car park

A 12-H.P. motor provides the drive for the longitudinal track movement, the 16 ft travel occupying 10 seconds. Rapid movement is desirable for operational efficiency, but in order to avoid jerking the stationary cars, smooth acceleration on starting and a reverse action on stopping, are essential. These are ensured by choice of a suitable motor and by the nature of the mechanical drive. After geared reduction, a mechanical modulator imparts the desired type of motion to the track itself. A single-speed motor can thus be used effectively and a squirrel-cage motor is, in fact, employed for the purpose. The lateral traverse is effected by 1½-H.P. squirrel-cage motors, four in all being employed for this purpose.

Control System

The control system incorporated has been devised to enable a particular car to be started on its way out without it being necessary for the attendant in charge to see the car himself, to ensure that the operations take place in correct sequence, and to enable a number of calls for individual cars to be made, automatic "storage" of the calls being effected.

These problems are similar to those for which automatic telephone apparatus has been used successfully, and such telephone relays and "uniselector" stepping devices are employed. Automatic telephone apparatus is designed to work on a d.c. supply of 50 V, and as it was felt that a higher degree of reliability would be attained if the limit switches, which terminate each movement, cancelled both the contactor for the motor and the appropriate relay circuit, contactor coils were wound for the same 50-V supply. Photo-cell equipment is provided to ensure that no car is standing too far forward or too far back on its section of the unit. In the event of such wrong positioning, the system is arrested and a warning signal, both audible and visible, is given.

A further development, now in hand, is a photo-cell equipment to measure the cars as they arrive on the ramp, effecting an automatic sorting of large, small and medium-sized cars, so that they may be segregated in appropriate parking bays.

Export Inquiries

WE have received the undermentioned inquiries from firms and individuals overseas who wish to secure agencies for British electrical equipment and appliances or to import them into their territories. We shall be glad to pass on to them replies received from readers which should be addressed to the Editors, quoting the number given in parentheses. We cannot vouch for the standing of inquirers and manufacturers replying to them will no doubt require the usual references:—

Egypt.—An Egyptian firm urgently wishes to get in touch with manufacturers who would be willing to supply the Middle East market with any of the following goods:—

Bayonet type brass lamp-holders, twin lead-covered wires, ¾ in. steel conduit, insulating tapes, watt-hour meters, fluorescent lamps and fittings and any quantity of insulating varnishes. (X. 172).

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

J. & E. Hall, Ltd., report a net profit for the past year, before meeting tax, of £111,772 as compared with £98,911 for the previous year. The dividend for the year is unchanged at 10 per cent.

The directors propose to increase the authorized capital to £1,000,000 by the creation of 200,000 undesignated shares of £1 each. It is also proposed to convert the whole of the issued and fully paid preference and ordinary shares into stock.

R. A. Lister & Co., Ltd., report a trading profit for the year to September 30th last of £370,683, as compared with £366,858 for the preceding year, and a net profit of £175,889 (against £137,077). The final ordinary dividend is maintained at 5 per cent, but the bonus is raised from 6 per cent to 8 per cent, making a total of 18 per cent for the year (against 16 per cent). On the 300,000 shares of £1 issued during the year, the final dividend is 2½ per cent with a bonus of 4 per cent. The balance carried forward is £150,254 (against £73,836 brought in).

The Yorkshire Electric Power Co. is to hold its annual meeting this year in March instead of in February as has formerly been the practice. This step has been taken to enable the annual meeting to be held at a time when the position under the Electricity Bill has become more clarified than it is at present.

International Combustion, Ltd., reports a net profit for the year ended September 30th last of £233,767, as compared with £206,283 for 1944-45. The final ordinary dividend is 22½ per cent, plus a bonus of 5 per cent, making the total distribution for the year 37½ per cent (against 32½ per cent.).

New Companies

Hallam & Middleton, Ltd.—Registered January 24th. Capital, £2,000. To acquire the business now carried on by L. R. Hallam and C. E. Middleton at High Road, Streatham, S.W. as Hallam & Middleton, and to carry on the business of electrical contractors and engineers, etc. Directors: L. R. Hallam, C. E. Middleton and J. R. Cort Bathurst. Regd. office: 97/9, High Road, Streatham, S.W.16.

Watson Electrical Co., Ltd.—Registered January 22nd. Capital, £5,000. Directors: R. C. Watson, Mrs. Eva M. Watson, F. N. Watson, R. H. S. Watson and A. Watson. Regd. office: 244, Lickey Road, Rednal, Birmingham.

Landalls, Ltd.—Registered January 23rd. Capital, £1,500. Designers and manufacturers of, and dealers in, electrical, radio, sound recording and television apparatus and accessories, etc. Directors: L. H. Allen and E. W. Landrigan. Regd. office: 50, Deptford Broadway, S.E.8.

British Signs, Ltd.—Registered January 22nd. Capital, £1,500. To acquire the business of erection, repair and maintenance of neon or other electrical signs carried on by H. J. E. Haigh and L. G. McConomy as "Neon Sign Service" at 31, North John Street, Liverpool. Directors: L. G. McConomy, H. J. E. Haigh, and A. J. Brown. Regd. office: 68, Derby Road, Liverpool, 20.

Arthur Barrow & Son, Ltd.—Registered January 23rd. Capital, £1,000. To acquire the business of an electrical engineer carried on by Arthur Barrow at 65, Rochdale Road, Burnley. Directors: Arthur Barrow and Alan Barrow. Regd. office: 65, Rochdale Road, Burnley.

Liquidations

Richardsons Westgarth-Brown Boveri, Ltd.—Particulars of claims by March 14th to the liquidator, Mr. J. H. Tate, of Peat, Marwick, Mitchell & Co., 13, Mosley Street, Newcastle-on-Tyne. (Members' voluntary winding-up.)

Coventry Automatic Telephones, Ltd.—Meeting March 5th at 31, Copthall Avenue, London, E.C.2, to receive an account of the winding-up by the liquidator, Mr. W. E. Fordham. (Members' voluntary liquidation.)

Trade Marks

THE following applications have been made for the registration of trade marks. Objections may be made within a month from January 29th:—

CASLOX. No. 642,447. Class 9. Magnets of oxide powder for use in electrical apparatus and instruments.—Plessey Co., Ltd., 56, Vicarage Lane, Ilford, Essex.

COROTHENE. No. 644,936. Class 9. Electrical apparatus and instruments included in Class 9.—Percy Buttimore trading as P. Buttimore (Export) Co., 51, Crutched Friars, London, E.C. 3.

MEDITRON. No. 644,945. Class 10. Apparatus for radio-therapy.—A. H. Ratcliffe, 17-21, Victoria Station Approach, Manchester, 3.

XCEL (design). No. B643,083. Class 11. Electric heating and cooking stoves, electric radiators, electric immersion heaters, electrically heated panels for installation in buildings, air heating plant and electrically heated towel rails. —Elexcel, Ltd., Victor Works, Broad Green, Liverpool, 14.

MOTORS
GENERATORS

CONTROL GEAR
AIR BREAK
OIL IMMERSED
HAND OPERATED
AUTOMATIC

SWITCHGEAR
SWITCHES
FUSES
SWITCHBOARDS
AIR BREAK
OIL IMMERSED

FANS
CEILING
DESK and
BRACKET
VENTILATING

LIGHTING FITTINGS
GAS FILLED
DISCHARGE

OF IMPORTANCE TO YOU

In order that we may give you the best service under the present difficult conditions we appeal to you to utilise standard equipment, ratings, etc., whenever possible. Your co-operation in this respect will enable us to concentrate on standard production with consequent reduction in despatch time.

USE "STANDARD"

VERITYS Ltd.

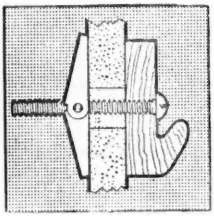
Sales Headquarters : **BRETTENHAM HOUSE, LANCASTER PLACE, W.C.2**

Works : **ASTON, BIRMINGHAM 6**

PERMANENT FIXINGS

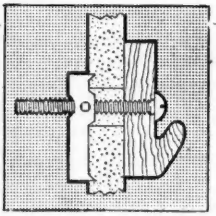
Can now be made to Wallboards, Plaster Boards
Insulating and Laminated Boards
Hollow Bricks and Tiles

TOGGLE BOLTS

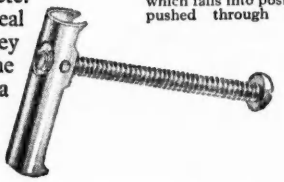


SPRING TYPE
The wings of the toggle spring open at right angles to the screw when pushed through the hole.

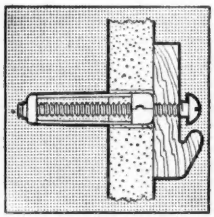
Rawlplug Toggle Bolts provide a simple means of making fixings to hollow partition walls or ceilings, asbestos board, hollow bricks and tiles, etc. They are ideal because they distribute the strain over a wide area.



GRAVITY TYPE
The toggle has a long end which falls into position when pushed through the hole.



RAWL-ANCHORS



RAWL-ANCHORS are manufactured from ductile steel and ensure very firm fixtures. Fixing is simplicity itself—just a ½" diam. hole into which the Rawl-Anchor is placed and then the screw is tightened. Millions have been used on housing contracts.

An extremely ingenious device. When the screw is tightened the Rawl-Anchor collapses as shown in the illustration. In certain materials this makes a permanent tapped fitting from which the screw can be removed & replaced at will.

B322

★ *Samples of any or all of these fixing devices will be gladly supplied to the trade for testing purposes.* Also the advice of our Technical Service Department is available for free unbiased assistance in overcoming any peculiar fixing problems.

THE RAWLPLUG Co. Ltd., CROMWELL ROAD, LONDON, S.W.7

T.3623

STOCKS AND SHARES

THE volume of Stock Exchange business has fallen off, owing partly to weather conditions, partly to political considerations. The daily cuts in electricity had no effect upon prices of the shares in the supply companies, but they certainly played a part in checking business activity. The influence of the recently-issued White Paper has started to wane, although the insistence of the Government upon shortage of fuel and man-power has induced a considerable degree of caution. Nevertheless, the weight of money tells, and the capital available for investment is a continual factor, serving to keep prices steady and to counteract what might otherwise be the consequence of sales by people nervous of the outlook for industrials. The decision of the Conservative party to move the rejection of the Electricity Bill was welcomed in the Stock Exchange market as a witness to the vigorous character of the Opposition's attitude.

Central Electricity Board

Stocks of the Central Electricity Board are to receive, under nationalization, the same treatment as that accorded to the supply companies. As was the case with the L.P.T.B. stocks, the Bill gives no recognition to the existence of contractual redemption terms. Present prices as compared with the take-over figures are as follows :—

Stock	*Compensation Price*	*Market Price*
C.E.B. 5% 1950-70 ..	108½	105½
C.E.B. 5% 1955-75 ..	117½	112½
C.E.B. 4½% 1957-82 ..	116½	111½
C.E.B. 3½% 1963-93 ..	113	108½
C.E.B. 3½% 1974-94 ..	111¾	107½

The particular point to be noted is, of course, the wide margins between the two sets of prices.

Electricity Debentures

Figures have been given here recently to illustrate the prospective loss of income which faces holders of electricity supply ordinary and preference shares, should these be exchanged for a compensation stock bearing interest at 2½ per cent. In the case of debenture stocks, the cut would be no less serious. As in the case of preference shares, it is the high interest bearing issues which stand to fare worst; and, in common with the C.E.B. stocks, the debentures would be treated with complete disregard for contractual redemption rights.

Loss of Income

On the average, the income from £100 electricity supply 3½ per cent debenture stocks stands to fall, on nationalization, from £3 10s. 0d. to £2 11s. 6d. per annum. This is the case, for instance, with the London Power, Midland Counties, North-Eastern and Yorkshire Power 3½ per cent debentures, all of which have an estimated take-over price of about 103. Current market prices are 3 or 4 points below that figure. Of the 5 per cent debentures, those of City of London and County of London, with a compensation price of about 120, would lose 40 per cent of the income, which would drop to £3. But on London Power 5 per cents, which were depressed by the proximity of an optional redemption date in 1952, and which consequently have a take-over price of only 104½, the income would be cut to £2 12s. 3d. Compensation prices for most of the 3½ per cent issues are between 100 and 103, and the prospective loss of interest is a little over 20 per cent. On Edmundsons and Electric Distribution of Yorkshire 3½ per cent debentures, for instance, the dividend would shrink to £2 10s. 6d., the compensation price being 101½ compared with the present market price of 97½.

The Week's Price Changes

International Combustion shares are quoted officially at 10½ middle, showing a fall of 5s. on the week, but actually the market is better at 10¾ bid, on the report and the increase in dividend of 5 per cent to 37½ per cent. The yield is still modest, but it is pleasant to see a company raising its dividend out of increased profits, rather than doing this by bringing into the accounts money previously reserved against taxation. Telegraph Constructions have been a good market, with a rise of 2s. 6d. to 61s. 6d. Amongst other prices to show improvement on the week are Marconi Marine, 3s. 6d. up to 37s. 6d., and Crompton at 34s. 6d.

Miscellaneous Movements

Price fluctuations in the electricity supply group are mixed. Small gains advanced Lancashires to 36s., North Easterns to 35s., and Metropolitans to 46s. 3d. Scottish Power fell 1s. to 44s. The radio group is rather dull, with Pye 32s. 6d., Decca 56s. 3d., and Cossor 31s. 3d. Anglo-Portuguese Telephones fell 1s. 6d. to 31s., on the proposed developments. Associated Electrics at 72s. show a florin fall. Lancashire Dynamo have gone back ⅛ to 5⅞. Lighter declines have made Siemens 38s., General Electrics 101s. and English Electrics 65s. Crompton Parkinsons rose 1s. 6d. to 34s. 6d. Cable & Wireless ordinary at 149½ and the preference at 121½ have put on 3 and 2 points respectively.

Brush Electrical Engineering

Shareholders of Brush Electrical Engineering are expecting to receive, before long, capital proposals in connection with the consolidation of the oil-engine manufacturing business. Discussions are reported to have taken place between Brush and other companies in the same field with a view to a merger of interests, and a scheme is to be submitted to the Capital Issues Committee. Mr. Alan Good has returned to the board as managing director, and has resigned from other directorships. Pending confirmation and details of the expected proposals, the 5s. shares have remained a quiet market at about 7s. 9d.

Forthcoming Events

Monday, February 10th.—NEWCASTLE-ON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "The Growing importance of Plastics in the Electrical Industry," by G. E. Haefely.

Tuesday, February 11th.—LONDON.—At the Royal Society of Arts, John Adam Street, W.C.2, 6 p.m. Illuminating Engineering Society. "The Brightness and Legibility at Night of Road Traffic Signs," by J. S. Smith.

At the Institution of Electrical Engineers, Savoy Place, W.C.2, 5 p.m. Institution of Post Office Electrical Engineers. "Development of Telephone Transmission over Lines in the last 40 years," by R. M. Chamney.

NOTTINGHAM.—City Gas Department, 6.30 p.m. I.E.E. East Midland Centre. "Power Supply for Generating Station Auxiliary Services," by W. Szwander.

LEEDS.—Corporation Electricity Department, Whitehall Road, 6 p.m. I.E.E. North Midland Centre. "A Survey of the Development of Radar," by R. A. Smith.

BELFAST.—Queen's University, 6.45 p.m. I.E.E. Northern Ireland Centre. "Industrial Applications of Electronic Techniques," by H. A. Thomas.

LIVERPOOL.—Corporation Electricity Showrooms, Whitechapel, 6 p.m. Illuminating Engineering Society (Liverpool Centre). "Coloured and Directional Lighting as applied to the Theatre," by L. C. Applebee.

Wednesday, February 12th.—LONDON.—Lighting Service Bureau, 2, Savoy Hill, W.C.2, 7 p.m. Electrical Power Engineers' Association (London Technical Group). "Feed Water," by E. A. Howes.

Institution of Electrical Engineers (Transmission Section), 5.30 p.m. "The Operational Characteristics of Modern H.V. Wood-Pole Lines," by G. T. Garwood.

I.E.E. London Students' Section, 2.30 p.m. Visit to the Mullard Co.'s Mitcham factory.

BIRMINGHAM.—Grand Hotel, 7 p.m. Electrical Power Engineers' Association (Midland Technical Group). "Mercury Arc Rectifiers," by J. Milne.

At the Institution of Mechanical Engineers, Storey's Gate, S.W.1, 2.30 p.m. Institution of Heating and Ventilating Engineers. Presidential address.

EDINBURGH.—Electricity Department Showrooms, 127, George Street, 7.30 p.m. Edinburgh Electrical Society. "Electrolytic Capacitors," by J. H. Cozens.

Heriot-Watt College, 6 p.m. I.E.E. Scottish Centre. "A Survey of the Development of Radar," by R. A Smith.

Thursday, February 13th.—LONDON.—Institution of Electrical Engineers (Installations Section), 5.30 p.m. "Protective Finishing of Electrical Equipment," by F. Widnall and R. Newbound.

Alliance Hall, 2.30 p.m. Diesel Engine Users' Association. Resumed discussion on the Report on Heavy-Oil Engine Working Costs.

DUNDEE.—Royal Hotel, Union Street, 7 p.m. I.E.E. North-East Scotland Sub-Centre. "Comparisons between Gas and Electricity on the Basis of Coal Economy," by P. Schiller.

Friday, February 14th.—LONDON.—Connaught Rooms, Great Queen Street, W.C.2, 12.30 p.m. for 1 p.m. British Electrical and Allied Industries Research Association. Annual luncheon.

ABERDEEN.—Caledonian Hotel, 7.30 p.m. I.E.E. North-East Scotland Sub-Centre. "Electrical Control of Dangerous Machinery and Processes," by W. Fordham Cooper.

Monday, February 17th.—LIVERPOOL.—Royal Institution, Colquitt Street, 6 p.m. I.E.E. Mersey and North Wales Centre. "The Development and Design of Colonial Telecommunication Systems and Plant," and "The General Planning and Organization of Colonial Telecommunication Systems," by G. Lawton and V. H. Wilson.

LONDON.—St. Ermin's Hotel, S.W.1. Association of Supervising Electrical Engineers (Central London Branch). Film and lecture, "Modern Application of Mercury Arc and Metal Plate Rectifiers and Variable Speed Equipments," by J. Milne.

NEWCASTLE-ON-TYNE.—King's College, 6 p.m. I.E.E. North-Eastern Centre (Radio and Measurements Group). Annual general meeting.

BRISTOL.—Victoria Rooms, 6.30 for 7 p.m. I.E.E. Western Centre. Dinner-Dance.

BIRMINGHAM.—Grand Hotel. Birmingham Electric Club. "Maximum Demand Limitation," by A. H. Gray.

BRADFORD.—Technical College, 7.15 p.m. Bradford Engineering Society. "Electrical Driving for Textile Machinery," by A. J. Francis.

Tuesday, February 18th.—LONDON.—I.E.E. London Students' Section, 7 p.m. Discussion on "Radio Modulation Methods—Amplitude, Phase, Frequency and Pulse," opened by G. Dawson, D. Deacon and R. F. Howard.

MANCHESTER.—Engineers' Club, Albert Square, 6 p.m. I.E.E. North-Western Centre (Measurements Group). "A Millisecond Chronoscope," by R. S. J. Spilsbury and A. Felton, and "A Sensitive Recording Magnetometer," by A. Butterworth.

GLASGOW.—University. Institute of Physics (Scottish Branch). "Dielectric Heating," by A. J. Maddock.

Friday, Febuary 21st.—LONDON.—Electrical Trades' Commercial Travellers' Association. Connaught Rooms. Annual lunch.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

A. ABBEY (Ohio Carbon Co.).—" Electrical resistor units." 24796. December 11th, 1944. (584542.)

G. A. Abraham.—" Electrical fence and like insulators." 22600. November 15th, 1944. (584608.)

T. N. Adlam.—" Thermostatically controlled valves." 13608. July 17th, 1944. (584515.)

O. P. Alexander.—" Control of electric motors for operating the wing flaps of aircraft." 886. January 10th, 1945. (584617.)

Automatic Telephone & Electric Co., Ltd., and T. R. Rayner.—" Electrical signalling systems." 795. January 10th, 1945. (584604.)

Babcock & Wilcox, Ltd., and W. L. Tyldesley.—" Tubular heat exchangers." 16261. August 28th, 1944. (584524.)

J. Brennan.—" Operation of electric discharge tubes." 139. January 2nd, 1945. (584566.)

British Insulated Cables, Ltd., and J. C. Quayle.—" Construction of electric condensers and resistors." 14772. August 2nd, 1944. (584549.)

British Thermostat Co., Ltd., and J. S. Ogden.—" Thermostatic control devices." 1177. January 15th, 1945. (584636.)

British Thomson-Houston Co., Ltd.—" Casting pattern compositions." 20164/44. October 18th, 1943. (584407.) " Switch actuating mechanisms." 925/45. January 11th, 1944. (584621.)

British Thomson-Houston Co., Ltd., and L. J. Clark.—" Prevention of ice formation on the rotating parts of aircraft." 82. January 1st, 1945. (Addition to 525452.) (584563.)

British Thomson-Houston Co., Ltd., and W. H. Maycock.—" Means for automatically disabling the ignition of an internal-combustion engine at a predetermined engine speed." 775. January 9th, 1945. (584603.)

British Thomson-Houston Co., Ltd., and E. B. Tuppen.—" Air or fluid pressure regulators." 774. January 9th, 1945. (584602.)

British Thomson-Houston Co., Ltd., A. P. Castellain and A. Bowen.—" Photographing of cinematograph images." 13726. July 18th, 1944. (584517.)

British Thomson-Houston Co., Ltd., H. W. C. Liddiard and T. H. Petch, jun.—" Apparatus for power-factor correction of synchronous motor driven generator sets." 6430. April 6th, 1944. (584440.)

David Brown & Sons (Huddersfield), Ltd., and W. A. Tuplin.—" Cooling of gear units, electric motors, or the like." 20599. October 24th, 1944. (584535.)

Carr Fastener Co., Ltd., and G. W. Clark.—" Holders for thermionic valves, plugs, and like electrical devices having a series of projecting terminal pins." 1035. January 12th, 1945. (584629.)

C.A.V., Ltd., and T. Curzon.—" Electric circuit-breakers and indicating devices therefor." 24619. December 8th, 1944. (584417.)

Chloride Electrical Storage Co., Ltd. (R. Jardine).—" Electric accumulators." 1518. January 18th, 1945. (584656.)

R. H. Colborne and E. J. C. Bowmaker.—" Bases for electron discharge and similar devices." 20568. October 24th, 1944. (584409.)

J. Collard.—" High-frequency apparatus embodying impedance matching transformers." 10725. June 3rd, 1944. (584444.)

A. G. Crossland.—" Electric light fittings." 1305. January 16th, 1945. (584648.)

Dubilier Condenser Co. (1925), Ltd., and J. Goodman.—" Containers for condensers and other electrical components." 19938. October 16th, 1944. (584552.)

English Electric Co., Ltd., and E. A. Binney.—" Dynamo-electric machines." 4305/46. February 24th, 1944 (Divided out of 579570.) (Addition to 560531.) (584424.)

Eureka Vacuum Cleaner Co.—" Suction cleaners." 25470/44. December 22nd, 1943. (584478.)

Express Lift Co., Ltd., and F. W. F. Goffe.—" Phase-sensitive relays." 25021. December 13th, 1944. (584543.)

Fairey Aviation Co., Ltd., and A. G. Forsyth.—" Electrically operated pitch-changing mechanism for screw propellers." 12491/44. August 12th, 1943. (584450.)

General Electric Co., Ltd., and L. C. Jesty.—" Scanning of a fluorescent screen by cathode rays." 3629. February 28th, 1944. (584494.)

General Electric Co., Ltd., and W. G. Thompson.—" Electric conversion systems." 2713. March 2nd, 1942. (584485.)

General Motors Corporation.—" Refrigerator cabinets." 13587/44. October 29th, 1943. (584514.)

A. Herbert, Ltd., and W. France.—" Regulation of electrically controlled furnaces." 1251. January 16th, 1945. (584643.)

Hoover, Ltd. (Hoover Co.).—" Suction cleaners." 21447. November 2nd, 1944. (584413.)

H. Hughes & Son, Ltd., E. P. Harrison E. Smith and A. J. Hughes.—" Means for ascertaining and indicating the direction of the earth's or other magnetic field." 14611. July 31st, 1944. (584521.)

Humber, Ltd., and J. E. P. Burge.—" Systems of electrical distribution." Cognate applications 22297/44 and 22299/44. November 13th, 1944. (584414.)

A. C. Mallinson.—" Electric radiators." 9409. April 16th, 1945. (584423.)

Marconi Instruments, Ltd., and K. H. Newhouse.—" Combined glass electrode and thermionic valve for use in the measurement of hydrogen-ion concentration and similar quantities." 684. January 8th, 1945. (584597.)

Marconi's Wireless Telegraph Co., Ltd.—" Regeneration of telegraph signals." 473/44. January 11th, 1943. (584374.)

Measurement, Ltd., C. F. Clifford and F. Hilton.—" Prepayment mechanism." 15942. August 21st, 1944. (584550.)

Metropolitan-Vickers Electrical Co., Ltd., and F. R. Mason.—" Electric distribution networks." 1064. January 12th, 1945. (584633.)

Muirhead & Co., Ltd., and W. C. Lister.—" Bobbins for electric coils." 22855. November 17th, 1944. (585474.)

H. Nuttall and A. Waddington.—" Protective means for electrically heated cooking apparatus." 896. January 11th, 1945. (584618.)

Patelhold Patentverwertungs-Elektro Holding Akt.-Ges.—" Transmission of signals by two-way radio communication with directional aerial." 13169/44. July 26th, 1943. (584513.)

Philips Lamps, Ltd., and R. A. Etherington.—" Magnetic separators." 13485. July 14th, 1944. (Addition to 527771.) (584392.)

Pirelli-General Cable Works, Ltd., H. Barron and C. F. Williams.—" Manufacture of electrically insulated wires." 375. January 4th, 1945. (584574.)

Pye, Ltd., and C. J. Carter.—" Arrangement for obtaining the stereophonic reproduction of sound." 2960. February 23rd, 1943. (584427.)

Pye, Ltd., and H. S. Hall.—" Tuning and the like control devices for electrical apparatus." 702. January 9th, 1945. (584599.)

M. Rosenfeld.—" Electrical contact devices for electric transformers and the like." 1610. January 19th, 1945. (584660.)

G. R. Shepherd (Westinghouse Electric International Co.).—" Process for the manufacture of composite materials for example, moulded laminated structures and articles of manufacture produced thereby." 21809. December 29th, 1943. (584431.)

Siemens Bros. & Co., Ltd., and D. A. Christian.—" Automatic telephone systems." 576. January 6th, 1945. (584590.)

Siemens Bros. & Co., Ltd., and D. P. Long.—" Automatic telephone systems." 333. January 4th, 1945. (584572.)

Siemens Bros. & Co., Ltd., and F. A. Stallworthy.—" Electrical selective signalling systems." 575. January 6th, 1945. (584589.)

Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington.—" Electric discharge lamps." 9786. May 20th, 1944. (584442.)

S. Smith & Sons (England), Ltd., and E. B. Moss.—" Electrical resistances." 949. January 11th, 1945. (584625.)

Sperry Gyroscope Co., Inc.—" Radio measurement of the distance of an object." 6578/44. April 10th, 1943. (584496.)

Standard Telephones & Cables, Ltd.—" Synchronizing for multiplex electric impulse communication systems." 14674/44. September 29th, 1943. (584457.) " High-frequency cables and methods of balancing the same." 97/45. January 8th, 1944. (584564.) " High-frequency coupling circuit for supplying multiple loads." 682/45. March 29th, 1944. (584595.) " Oscillator system for modulating the operating potential for an electric device." 683/45. April 4th, 1944. (584596.)

Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).—" Arrangements for generating synchronous pulses and scanning voltages." 19611. November 24th, 1943. (584606.)

Standard Telephones & Cables, Ltd., and A. Mortlock.—" Electrical amplifiers." 23729. November 28th, 1944. (584475.)

Standard Telephones & Cables, Ltd., M. M. Levy and E. A. Ruttue.—" Arrangements for modulating continuous electric waves." 1217. January 15th, 1945. (584642.)

Svenska Aktiebolaget Gasaccumulator.—" Means for measuring phase angles, suitable for determining, for example, radio directions." 367/45. January 4th, 1944. (584573.)

S. M. Taylor.—" Thermionic valve counter circuits." 26192. December 30th, 1944. (584422.)

Telegraph Condenser Co., Ltd., P. A. Sporing and C. P. Johnson.—" Tubular containers for electrical condensers or other apparatus." 8678. May 8th, 1944. (584379.)

W. W. Triggs (Akt. Ges. Brown, Boveri, & Cie.).—" Moving-contact electric current converters." 393. January 4th, 1945. (Convention date not granted.) (584577.)

Western Electric Co., Inc.—" Pulsing arrangements for electron discharge devices." 12970/44. July 9th, 1943. (584452.) " Apparatus for varying or modulating the frequency of crystal controlled circuits." 17352/44. September 16th, 1943. (584465.)

Westinghouse Brake & Signal Co., Ltd., and A. H. B. Walker.—" Voltage regulating apparatus for polyphase alternating current circuits." 25532. December 20th, 1944. (584420.)

Westinghouse Brake & Signal Co., Ltd., L. E. Thompson and K. A. Garrod.—" Manufacture of alternating current rectifiers of the selenium type." 14088. July 24th, 1944. (584519.)

Westinghouse Brake & Signal Co., Ltd., L. E. Thompson and A. Jenkins.—" Alternating electric current rectifiers of the selenium type." 20746. October 25th, 1944. (584554.)

Westinghouse Electric International Co.—" Carbonating apparatus." 17224/44. September 11th, 1943. (584530.) " Production of corrosion-resistant phosphate coatings on metal surfaces." 20894/44. November 13th, 1943. (584537.) " Inductive apparatus, for example, electric transformers." 1039/45. January 29th, 1944. (584630.) " Transformer structures." 1040/45. January 29th, 1944. (584631.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Belfast.—February 21st. Electricity Department. Supply of various stores. (January 31st.)

Birkenhead.—February 17th. Electricity Department. Twelve months' supply of electric lamps. (January 24th.)

Bletchley.—March 31st. U.D.C. Three sets of electrically driven vertical sewage pumps. John Taylor & Sons, Artillery House, Westminster, S.W.1.

Bridgnorth.—February 17th. Town Council. Electrical installations in 120 houses. W. McIntyre, town clerk, Municipal Offices, College House.

Felling.—February 17th. U.D.C. Electric wiring, fittings, equipment, materials and components for forty-two houses at Stone Street, Windy Nook. Surveyor, Council Buildings.

Hertford.—February 17th. Colne Valley Sewerage Board. Provision and laying of cable, fixing of distribution switch- and fuse-gear, lighting fittings, lamps and lamp columns. (January 24th.)

Heston & Isleworth.—February 26th. Electricity Department. Materials for the year ending March 31st, 1948. (See this issue.)

Huyton-with-Roby.—February 20th. U.D.C. Electric cables and flexes (Reference No. 18); electric lamps (19); and electrical sundries (20), for one year from April 1st, 1947. A. W. Thomas, surveyor, Council Offices, Huyton, near Liverpool.

Kettering.—March 3rd. Electricity Department. Two 11,000-V, 3-phase, 50-cycles, 150,000-kVA switch units. (See this issue.)

Manchester.—February 22nd. Electricity Committee. 110-V and 50-V batteries and charging equipments at substations. (January 31st.)

February 24th. Electricity Department. Electric cookers for twelve months ending March 31st, 1948. (See this issue.)

New Mills.—February 28th. U.D.C. Electricity Department. Transformers. (January 31st.)

Portsmouth.—February 12th. Electricity Department. Delivery and erection of distribution system diagram, generating station works auxiliaries, control and indication diagram, and automatic telephone equipment. (January 24th.)

February 24th. Town Council. Replacement of four motor-driven centrifugal pumps at Eastney pumping station. City engineer, 1, Clarence Parade, Southsea, Hants.

Sheffield.—March 3rd. Electricity Department. One 55-MVA, 33-kV oil-immersed copper-shielded reactor. (See this issue.)

March 16th. Three 1,000-kVA, 11,200/3,000-V transformers. (See this issue.)

Southampton.—February 21st. Electricity Department. P.i. insulated cables, stores and materials, domestic apparatus and electricity meters during the year ending March 31st, 1948. (See this issue.)

Southend-on-Sea.—March 10th. Electricity Department. Private automatic branch telephone exchange. (See this issue.)

Stockport.—February 17th. Electricity Department. Medium-duty centralized control radial drilling machine. (January 31st.)

Weymouth and Melcombe Regis.—Electricity Department. Supply of paper-insulated cable for twelve months commencing April 1st, 1947. (January 31st.)

Whitby.—February 15th. U.D.C. Two 1,000-kVA transformers. (January 31st.)

Winchester.—March 8th. City Council. Thirty steel lighting columns and one wall bracket, complete with fittings, for mercury vapour discharge lighting. (See this issue.)

Wolverton.—March 3rd. U.D.C. Twelve automatically operated vertical spindle pumps and motors for three sewage pumping stations. W. H. Radford & Sons, engineers, Albion Chambers, King Street, Nottingham.

Woolwich.—March 1st. Electricity Department. Switchgear and switch kiosks. (See this issue.)

Orders Placed

Bedlington (Northumberland).—U.D.C. Accepted. Electrical installations in 70 houses at Bishop's Meadow.—Mood & Son.

Ipswich. — Borough Council. Accepted. Completion of Cliff Quay power station buildings: terms of existing contract plus 22 per cent.—Edmund Nuttall, Sons & Co. Fifth 45,000-kW turbo-alternator and condensing plant (£275,572). — Metropolitan-Vickers. "Solkor" h.v. and earth-leakage protection at substations (£1,239).—A. Reyrolle & Co.

St. Pancras.—Electricity and Public Lighting Committee. Three 5-panel high-voltage, single busbar, metalclad switchboards for static substations (£2,962).—G.E.C. Two thousand 3-pint kettles (£1 15s. 11d. each).—Hotpoint Co. Cookers and fires.—English Electric Co.; Belling & Co. Refrigerators.—Electrolux; A.S.C.O. Ltd.; G.E.C. Clocks.—Smith's. Meters.—Ferranti. Electric oven interiors.—Stewart & Gray. Carbon brushes.—Le Carbone.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Basingstoke.—Houses (66), East Oakley, for R.D.C.; Fleetwood, Buss & Anns, surveyors, 4, Verulam Buildings, Gray's Inn, W.C.1.

Bethesda.—Factory for Cooper, Webb-Jones & Co., Ltd., Littleton Street, Walsall.

Bethnal Green.—Flats (50), Sceptre Road (£71,746); borough engineer.

Bilston.—Permanent houses (88), Stowlawn estate; borough architect, 20, Wellington Road.

Bridlington.—Houses (32) on three sites, for R.D.C. (£49,374); A. Schofield (Builders), Ltd., Hornsea.

Bromsgrove.—Houses (220), Rubery; F. W. Goodman, surveyor, The Council House.

Chesterfield.—Classroom and workshop block, Technical College, for Derbyshire E.C. (£26,500); F. H. Crossley, county architect, St. Mary's Gate, Derby.

Croydon. — Secondary school, Addington (£112,500); borough architect.

Cumberland.—Additions to Newton Rigg Farm Institute (£21,000); county architect, 4, Alfred Street North, Carlisle.

Derwent.—Houses (42), Barlby, for R.D.C. (£57,908); G. W. Rhodes, builder, St. Leonards Road, Barlby, Selby.

Dudley.—Houses (151) on Lodge Farm estate, Netherton; McKewan, Fillmore & McKewan, architects, 318, Hamstead Road, Handsworth, Birmingham.

East Grinstead.—Houses (180), Blackwell Farm site; surveyor, Urban Council Offices.

Exeter.—Nursery school, Chestnut Avenue (£11,088); Thomas Vanstone & Sons, Torquay.

Gateshead.—Factory extensions for the Reay Gear Works, Oakwellgate.

Glasgow.—Factory for Gray, Dunn & Co., Ltd., Stanley Street.

Houses (54), community rooms and central heating, Gower Street (£112,000); Gillespie, Kidd & Coia, architects for Corporation.

Hackney. — Houses (50), flats, laundry block, etc.; Messrs. Joseph, architects, 10, Lowndes Square, Belgrave Square, S.W.1.

Hampstead. — Flats (92), Upper Park (£193,000); borough engineer.

Havant.—Houses (102), Hayling Island; surveyor, Urban Council Offices, 1, Park Road.

Hornsey.—Flats (116), North Hill, Highgate; T. P. Bennett & Son, architects, 43, Bloomsbury Square, W.C.1.

Isle of Wight.—Houses (44) in rural area (£62,260); R.D.C. surveyor, 30, Pyle Road, Newport, I.W.

Kerlogue (Wexford).—Plastic and rubber factory for new company associated with Rubber Improvements, Ltd., Willesden.

Lambeth.—Flats, Denmark Road and Hemans Street (£194,000); borough engineer.

Lancashire.—Completion of three blocks of buildings, Moss Side Institution; Greenwood Bros. (Builders), Ltd., Longshaw Street, Warrington.

Lewisham.—Flats (330), Flower House estate (£415,777); Kent & Sussex Contractors, Ltd., Erith.

Limehurst. — Houses (50) for R.D.C. (£63,136); Bower, Moffatt & Co., Ltd., builders, 400, Rochdale Road, Harpurhey.

Liverpool.—Extensions, confectionery works, Anfield, for Barker & Dobson, Ltd. (£28,000); R. Costain & Sons (Liverpool), Ltd., Fazakerley.

Manchester.—Reinstatement of works, Claremont Road, Rusholme, after fire; E. Day & Sons, Ltd.

Mansfield.—Permanent houses (46), Bancroft Lane estate; borough engineer, Carr Bank.

Middlesex.—Temporary schools (£90,000); county architect.

Monmouth.—Houses (50), Wyesham estate (£59,006); W. Bowers & Co., builders, Bath Street, Hereford.

Nottingham.—Three blocks of buildings and nurses' home at Aston Hall Institution for Mental Defectives; borough engineer, Guildhall.

Ruthin.—Houses (84), Park-y-Dre (£97,288); R. A. Buckle, Ltd., builders, Gasworks Lane, Prestatyn.

Saddleworth.—Houses (42), Carrcote site; U.D.C. surveyor, Council Offices, Uppermill.

Salford.—Factory, 243, Bury New Road, for W. H. Sutton & Sons, 60, Spring Gardens, Manchester.

Shotton.—Extensions to works for John Summers & Sons, Ltd., Hawarden Bridge Steel Works; manager.

Stafford.—Factory, Foregate Street, for W. C. Dorman & Co.; Sandy & Norris, architects, 134, Newport Road.

Stoke Newington.—Flats, Green Lanes and Londesborough Road (£246,000); Howes & Jackman, architects.

Sunderland.—Factory for the Mayfair Cabinet Works; R. & G. Finlay, Ltd., builders, 28, West Sunniside.

Wednesbury.—Factory for J. Nesbit Evans & Co., Ltd.

West Hartlepool.—Houses on the Garry estate; Turnbull & Rowe, architects, 6, Scarborough Street.

Westminster.—Library, Charing Cross Road (£10,750); Riches & Blythen, architects for City Council.

Willesden.—Re-erection of factory in Oaklands Road, for Kenrosa, Ltd.